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INDUSTRY · SCIENCE · BUSINESS

NOVEMBER 1947

International Review of New Developments

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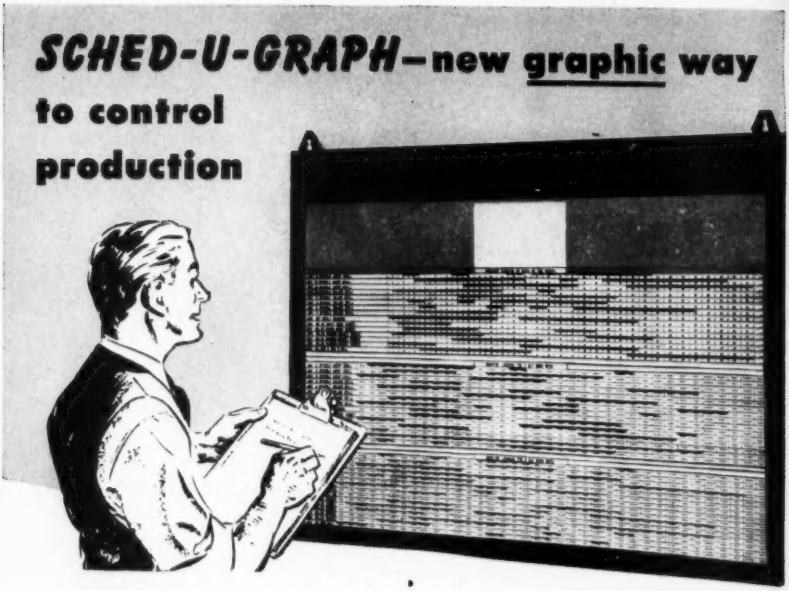
SCHED-U-GRAPH—new graphic way to control production



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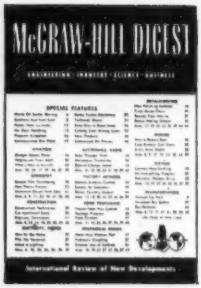

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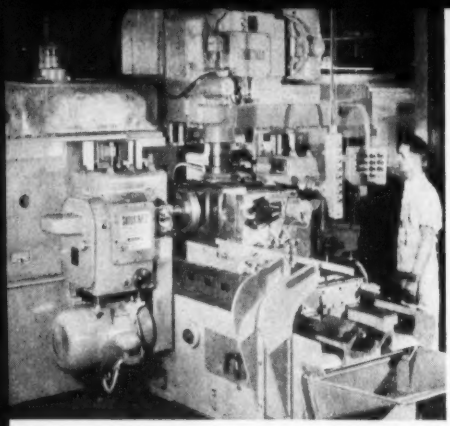
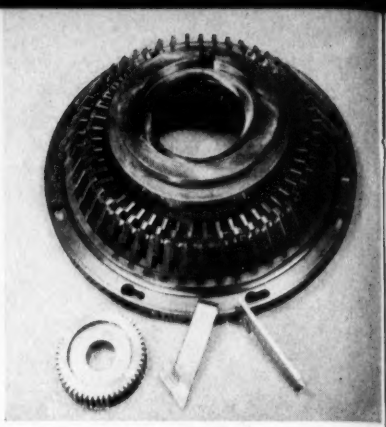


1 THREE-HEAD miller with ways for all movements is extremely accurate with large or small work. Completely electrified for speed and convenience, it has flexible control system.



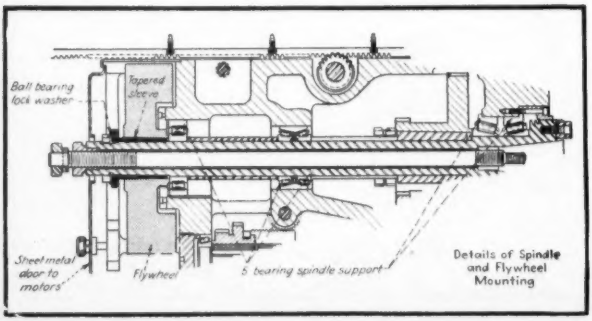
2 LESS THAN 1 MIN. is required to cut a gear with new shaper having one cutting blade for each tooth, mounted in this fixture. Blades feed in radially. Work is reciprocated.

New Machine Tool Designs

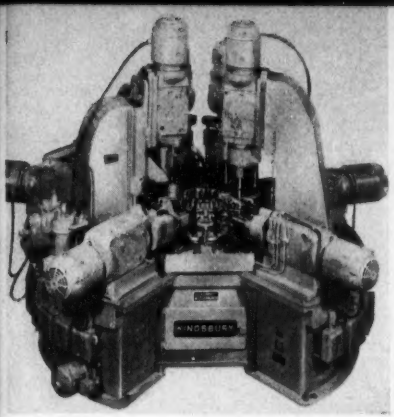
Exhibits at huge Machine Tool Show in Chicago reflect the decades of normal progress made in metalworking equipment in last few years

Important advances in design are reflected in the machine tools exhibited at the mammoth Machine Tool Show in Chicago. Decades of normal progress have been made in the past few years. Developments in all fields of industry and science have been incorporated in the designs of the new products. Improved alloys provide stronger sections, greater freedom from distortion, greater tensile and fatigue strengths, and higher wear resistance.

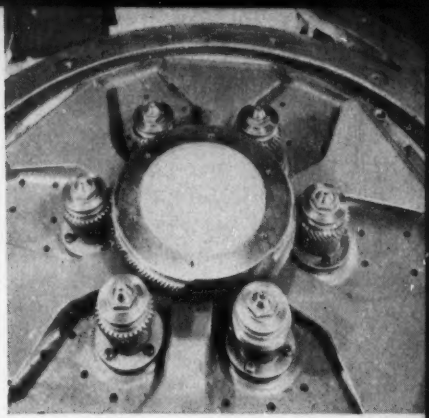
There now is a much greater range of sizes and capacities of electric, hydraulic, and pneumatic units. More precise manufacturing techniques assure longer life and better performance for mechanical drives. There is extensive use of elec-



5 TAPER - SLEEVE flywheel mounting replaces keying to reduce shaft stresses in new carbide-tooled miller. Inertia of heavy flywheel, mounted inside column, gives even application of power to avoid tool breakage.



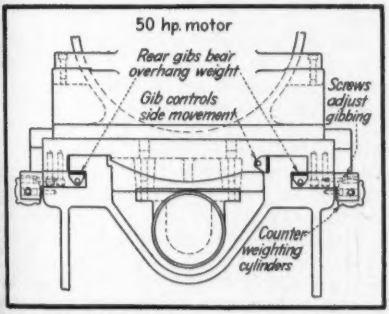
3 SUCCESSIVE operations with single chucking are performed by turret-type machine with number of cutting units and a central indexing turret with duplicate holding fixtures.



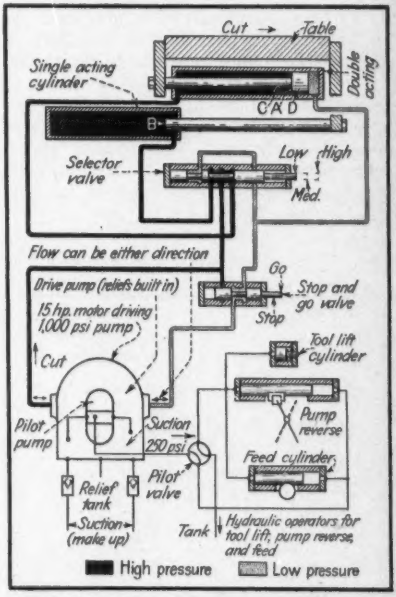
4 MULTIPLE GROUPS of teeth in 16-in.-dia. gap-type gear cutter divide amount of stock removal. Final group finish teeth to desired depth and thickness.

tronics for wider speed variations and quicker speed changing. High-frequency alternating current, supplied by converters incorporated in the machine, is delivered to motors direct-connected to spindles, driving them at high speeds without the need for mechanical speed amplification.

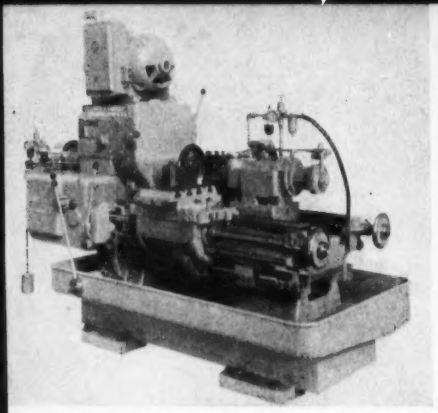
Refinements in all types of bearings and improved methods for their lubrication have permitted designers to specify



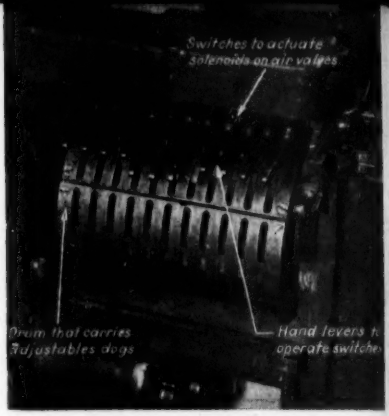
6 HYDRAULIC pressure replaces 3,600 lb. of lead in counterweighting a new vertical surface grinder, making machine 1½ tons lighter and less costly to build. Rigidity is attained by new square-gib construction with six bearing surfaces.



7 INGENIOUS dual hydraulic cylinder arrangement for driving planer table increases cutting force proportionately as table speed is reduced. For high speed, oil works on small area B; medium speed, on A and B.



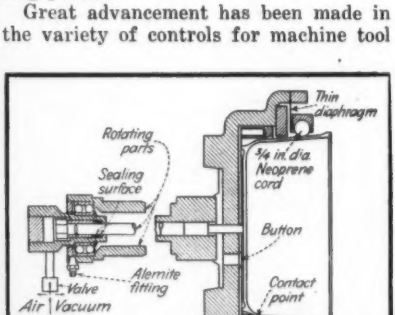
8 FULLY AUTOMATIC double lathe has independently actuated front and rear carriages, tool slides, and control boxes for identical or different operating cycles.



9 RAPID CHANGES in feeds and speeds of turret lathe are provided by multiple-disk air-operated clutches engaged by solenoids tripped by levers actuated by dogs on drum.

roller or ball bearings with full confidence of long service and higher precision in operation. This applies also to the sleeve-type bearings made of solid metal or powdered metal, metal-coated bearing liners, and the more recent use of tungsten carbide bearings for high-speed operation. New ways of sealing bearings made possible longer service between lubricating periods.

Great advancement has been made in the variety of controls for machine tool operation. Electronic controls use the various functions of the vacuum tube to achieve many results. Standard electrical controls, relays, switches, micro-action switches, and like details provide electrical means of accomplishing extremely varied machine functions. Similarly, the range of problems to which hydraulic controls can be applied has been vastly increased. Complicated operation sequences and cycle timing can be performed electrically, hydraulically, mechanically, or by a combination of these means.

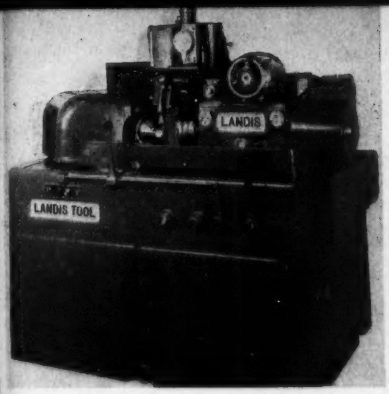


12 VACUUM HOLDS aluminum cooking utensils in an automatic lathe for high-speed machining. Chuck has neoprene cord on thin diaphragm to provide tight fit and allow for variations in pans.

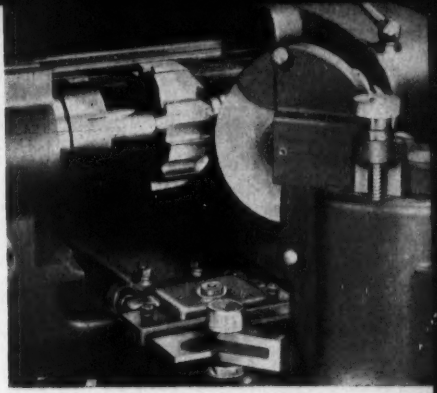
Capacities of 1947 and 1948 models of all types of machine tools have been raised far beyond those of their prewar prototypes. Greater power is inbuilt to assure ability to use the most advanced cutting tools, while increased rigidity in all members assures that the greater stresses of heavier cuts will not cause harmful deflections.

While new controls are more complex in the results they produce, they generally are simple in principle and usually accessible for maintenance.

Universal machines for the tool room have more power and wider ranges of feeds and speeds, doing work hardly possible in the production line ten years ago. New microform grinders permit high ac-



10 EASY ACCESSIBILITY for adjustments or repairs is provided in this automatic valve grinder. Cover and doors can be removed to get at electric and hydraulic units.



11 CONTOUR CUTTER sharpening machine produces convex or concave radii, angular faces, and combinations of these forms. Wheel-head follows template.

curacy with time savings in the production of precise form tools and crusher rolls.

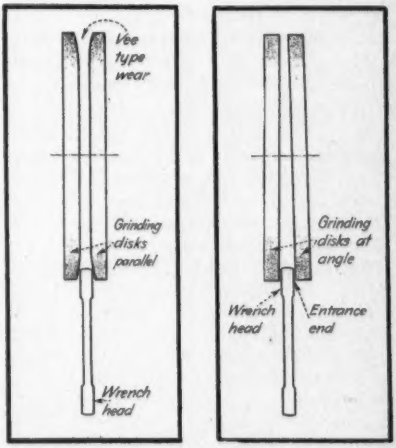
New machine tool models require less effort on part of operator. In many cases, "putting the workpiece in and taking it out" is an exaggeration of what the job involves. Now the machine often will take the work out.

Grinding wheels often are well away from the workpiece when loading the machine. Frequently the machine carries out part or all of the gaging requirements while it is grinding the workpiece.

New simplicity of operation, ease of set-up and control, and durability of the cutting tools mean much less need for small adjustments at end of each cycle.

Improved systems have been developed for handling coolants and removing the chips and grinding grit. Electric motors and controls are more standardized and are easy to get at in the event of a breakdown on the production line. All this means more uninterrupted production. The machine bases and guards have been styled so as to have fewer sharp corners and pockets to collect dirt. The machines are easier to clean.

Great progress has been made in safety. Starting and stopping buttons are more conveniently located. Guarding has been increased, and often the operator cannot start the machine until all guards are in position. Greater precautions have been taken for removal of atomized coolant and dust which might be harmful. —PRODUCT ENGRG.



13 NEW IDEA in progressive grinding is wheels set at angle (right) so that entrance opening is 0.030 in. wider than head of wrench ground. Wrench feeds itself through wheels. Conventional arrangement is at left.

Heat Pumps Have a Future

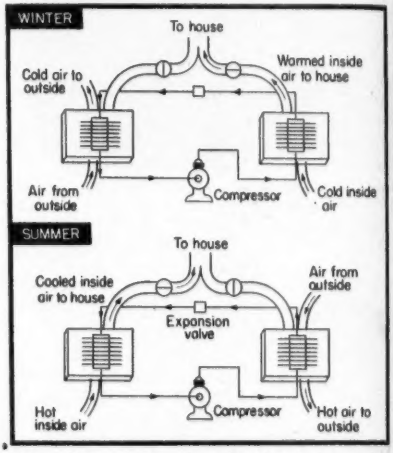
Units in operation are proving efficient, but performance must be improved. House-construction costs can be lowered by heat-pump installation

Current installations of heat pumps, or reverse-refrigeration units, have proved the workability of these units for winter heating and summer cooling. Units have been installed successfully in offices, commercial buildings, and private homes; 50 now are operating in the United States. At present, the ratio of heat energy produced to electrical energy consumed in operating a heat pump is about 3.5 to 1, but soon may be raised to 4.5 through use of hermetically sealed compressors for domestic heat pumps of 3-5-hp. capacity.

American Gas & Electric Co. has installed heat pumps in three of its buildings in Ohio. Performance ratios for the three installations are 3.6, 3.0, and 2.9 to 1. In a 20,000-cu. ft. private home in Riverside, Calif., one unit has a 5.13 performance factor; a unit in a 7,000-cu. ft. home in Indiana operates with a year-around performance factor of 3.61.

Heat-pump performance ratio is calulated in this way: Assume that 1 kwh. of electricity (3,414 Btu.) used by compressor enables the machine to "pump" 10,242 Btu. Then total heat output is 13,656 Btu., and the ratio of energy delivered to energy purchased is 4:1. Coefficient of performance, or "efficiency" of pumps, is then 4. Heat pumps with efficiencies of 3.5 become competitors of standard heating fuels if electric energy costs $0.01 per kwh. With electric energy at that price, it would cost $109 per yr. to heat in winter and cool in summer a 6-room Pittsburgh home—8,900 kwh. being used for winter heating, 2,000 kwh. for summer cooling.

Current engineering advancements in heat-pump design, including improved heat-transfer surfaces and decreased size and weight of unit, will tend to make



Reversible airflow in this heat-pump installation keeps refrigerant moving in the same direction for heating and cooling. For heating, inside air is passed over condenser. For cooling, air is directed over refrigerant expansion coils.

units more efficient for domestic installation. Complete units are now built which are 6 ft. long, 3½ ft. wide, and 6½ ft. high. Flexibility in installation permits location of the unit in the basement, attic, or ground floor utility room. Basement can be eliminated in heat pump-equipped homes. Other construction savings will be realized through elimination of chimneys and fuel-storage areas. Hot water or steam radiators and hot air ducts can be eliminated. The pump may result in a boom for radiant heating, which operates at lower temperature ranges than conventional heating systems. Smoke and fumes are eliminated; fire hazard is confined to electrical circuits.

Probably the localities best suited for use of heat pumps are those where cli-

mates are moderate, where heating and cooling loads are about in balance. If air is used as the heat source for the pump in areas where winter temperatures are extremely low, coefficient of performance falls rapidly. To get sufficient heat from the extremely cold air, great volumes of air would be necessary. This would demand an excessively large unit, with an increase in accompanying noise, vibration, and current used. For best year around efficiency, temperature of heat source should range between 40-80° F.—air, water, or earth may be used as the heat source.

In areas where winter temperatures are low, auxiliary heat could be provided by hot water stored in a tank, the water being heated when heat demand is low. A separate heater might be necessary to supply this stored hot water. Under normal conditions, a heat pump can provide hot water between 120-150°F. for household use the year around. Only necessary piping and storage tank would be additional to standard system.

The coal industry looks with interest to the expansion in the use of heat pumps. In the United States the industry estimates potential heat pump installations at 34,000,000. These would demand 155,000,000,000 kwh. of electric current which would take 100,000,000 tons of coal to generate. —COAL AGE

Atom Power "Bomb" Revealed

Essentially a controlled atomic bomb, radical new type of small nuclear pile uses plutonium and fast neutrons. It is an important step forward

Great new progress toward the practical generation of atomic power has been revealed. A radical new type of nuclear pile has been operating successfully at Los Alamos, N. M., since last November. It is a fast-neutron pile, essentially an atomic bomb in which the chain reaction is controlled. So far, it has been operated at a rate of only a few hundred watts, but the power level is limited only by the rate at which heat can be carried away.

The pile is the first to use plutonium instead of uranium as fuel, the first to employ fast neutrons, and the first to operate without a moderator.

The primitive piles built during the war operated on natural uranium containing only a tiny percentage of the fissionable U-235 isotope. In consequence, they just barely run. So many neutrons are absorbed in the nonfissionable uranium that there are hardly enough left to keep the reaction going. It is necessary to slow the neutrons to their most efficient speed by a carbon or heavy-water moderator. The pile requires hundreds of tons of uranium and moderator.

By contrast, the new pile, consuming almost pure plutonium, requires only a comparatively few pounds of material

EFFICIENT FOUNDRY—Molds for lasts at U. S. Rubber Co.'s Shoe Hardware Div. are made on this four-station turntable. Stationary sand slinger rams sand in flasks, excess sand falling through floor grates onto belt. Molds pass to pouring station on roller conveyor. —FACTORY

FACTORY MAKES HOUSES—Houses are produced on this ¼-mile production line at rate of 24-30 completely finished units a day on a three-shift basis. Houses are 26 ft. long and 15 ft. wide at wings. Wingfoot Homes, Inc., says houses can be erected at site in 4 hr. Price at the factory is $2,650. —ENGRG. NEWS-RECORD

(according to Werner Heisenberg, the German physicist, critical mass is about 30 lb.). And because there are few non-fissionable materials to absorb the fast neutrons, the "flux density" is high—that is, there are plenty of spare neutrons.

Presumably, the new pile was installed at Los Alamos, the bomb center, primarily for investigation of bomb physics. It permits study of the fast-neutron chain reaction used in the bomb.

But atomic experts long have been convinced that piles of this type would be needed for convenient and economical production of power.—ELECTRICAL WORLD

ATOM POWER EXPERIMENT BEGINS IN BRITAIN

Experimental production of atomic power began in Britain in mid-August. The Harwell pile is a low-power (perhaps a few watts) apparatus using a carbon moderator. It will be used for research on pile characteristics and perhaps for the manufacture of radioactive isotopes. A high-power pile will be completed next year at Harwell. Third stage in British program is construction of a high-temperature pile at Drigg, capable of producing some 75,000 kw. of usable power. Reportedly, this is to be a carbon-moderated pile using helium for heat-transfer.

Canada has had a low-energy pile, with a heavy-water moderator, in operation at Chalk River for some time. It produces plutonium in minute quantity for experimental purposes. A larger pile, for making radioactive isotopes, is believed to have been completed.—ELECTRICAL WORLD

CHARTS AND VISIBLE CARDS AID SCHEDULING

Production scheduling is speeded and controlled at Minneapolis-Moline Power Implement Co. through use of "lend-time" charts and visible schedule cards. Four people now handle all scheduling and machine loading, previously handled by 15 employees.

The lend-time and assembly chart lists lot number, day rate, and quantities at left side. Columns across remainder of page represent days of the month. Date on which assembly is to be completed is listed in date column by letter A. Three days prior to A-day is date at which all shop-made parts must be completed; this is entered as O-day. The three day interval has been found to be sufficient time to complete most parts. Special cases are given extra schedule time.

Visible schedule card file shows "operations to follow." One card is kept for each machining operation on shop-made

parts. Bottom of card shows number of operations to follow. This gives foreman information necessary to apply on lend-time chart. Also shown is actual production per machine, the card serving as a credit card for load debit. —FACTORY

PIPES STRENGTHENED BY HYDRAULIC EXPANSION

Steel pipe for transporting natural gas from Texas to Califiornia is being expanded under hydraulic pressure to give added strength and smooth out roughness. The minimum yield point of the 30-in.-dia. pipe is raised from 42,000 psi. to 52,000 psi. by the cold-working involved in expansion.

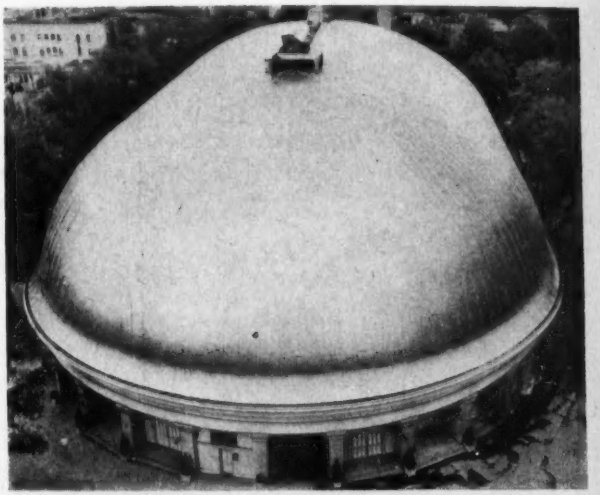
Manganese steel plates measuring 92 in. x 30 ft. and varying in thickness from 9/32 to 7/16 in. are processed in special machines to remove waves or buckles, trim edges, remove mill scale, square plates exactly, roll edges, and roll plate into cylindrical form. Submerged-arc process is used to weld seam. Pipes are 30 ft. long, outside dia. is 29¼ in. To expand pipe, ends are belled, bell starting 7 in. from each end. Then ends are plugged and sealed by gaskets, and pipe is filled with water. Internal pressure of 1,200-1,800 psi. expands pipe. In the operation, the pipe is shortened 2⅝ in. and wall thickness decreased about 0.003 in. Two sections are welded together, sandblasted, coated with primer and coal tar, and wrapped in asbestos felt before shipment to site.

The 214-mile pipeline, carrying 305,000,000 cu. ft. of gas per day, is buried in a trench providing a minimum cover of 2½ ft. —ENGRG. NEWS-RECORD

STEAM LOCOMOTIVE THROUGH?

Top executive of a leading locomotive company says that the steam locomotive soon will disappear from American railroads. It rapidly is being supplanted by the diesel locomotive. The higher availability of the latter enables it to retire three or four of the old steam jobs.

To meet coming competition of the gas turbine, diesel locomotives are designed for quick replacement of multiple power units. —AMERICAN MACHINIST



ALUMINUM DOME—Lightweight covering of preformed aluminum-alloy panels has been applied to 60,000-sq. ft. dome of Mormon Tabernacle in Salt Lake City. Oval-shaped dome is 250 ft. long, 150 ft. wide, 85 ft. high. Each of the 188 aluminum panels (128 radial, 60 straight) was accurately preformed and no additonal forming or bending was required at site. Extruded channel-shaped aluminum battens and caps interlock the formed-edge panels, the battens being screwed to wood deck. —CONSTRUCTION METHODS

Saving Through Safety

Safety program must be joint operation between safety engineer and department heads; must protect equipment as well as personnel

Too often, safety programs within a manufacturing plant mean only worker safety. But a complete program should include safety of machines, materials, tools, and equipment, as well as of personnel. In all well-planned programs, success will result only when the program has full support from executives, down to and including the foremen (McG-H Digest, Oct., p. 24). The foreman is the main factor in all safety programs.

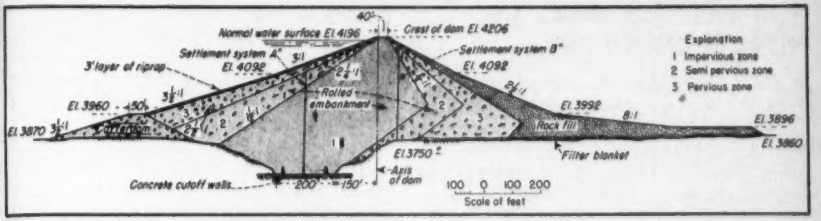
The safety engineer must work hand in hand with all department heads—production, maintenance, procurement, and health. The safety supervisor must have the complete cooperation of these men. In each department, the foreman must become the safety engineer's representative to correct unsafe practices and to report unsafe conditions to him.

Many companies figure their accident costs merely in relation to actual cash payments to operators while incapacitated. In reality, the costs are much greater. Ratio of indirect to direct costs is approximately 4:1. The greatest cost often passes unnoticed. Indirect costs include: lowered productivity by personnel in the injured person's section; foreman's time lost from production duties, consumed by taking person to dispensary and filling out forms; low production while replacement is being trained for the new job.

The injury may not be to the operator but to the machine itself. Here costs of injury mount rapidly, as one machine out of production may cause stoppages along the entire production line. Injuries to a machine frequently occur because the operator has become careless in his use of the machine. Safety devices are provided with most equipment. Often the operator will find it easier to operate the machine without using the provided safety mechanisms—by failing to use them he saves himself one or more motions. As the operator continues not to use the safety devices, he becomes more and more careless. The accident usually does not occur on the first improper operation of the machine, but after the operator has become accustomed to neglecting the safety devices. These safety violations can be spotted quickly by a safety-conscious foreman.

As an example of careless machine operation, a rotating surface grinder with a magnetic table was damaged and out of operation for 48 hr. because the operator failed to throw the switch magnetizing the table before he started the table rotating. The casting and grinding head were ruined and the splash-guard damaged; cost of accident was about $500. Safety engineer's solution was a relay between the two switches which

AID IRRIGATION—Plastic siphon tubes help lift water over edge of ditch to irrigate dry lands in Southwest U. S., converting them to grazing areas. —FOOD INDUSTRIES



HUGE EARTH DAM—Containing 9,078,000 cu. yd. of earth, this earth dam in Idaho is 2,500 ft. thick at stream level and 456 ft. high above foundation. Crest length is 1,400 ft.; crest width, 40 ft. Dam will create a 500,000-acre-ft. reservoir. Material used in Zone 1 was sandy clay, 95% passing ¼-in. screen, 33% passing 200-mesh screen. Average dry density was 119 lb. per cu. ft., moisture content, 12.7% of dry weight. Zone 1 fill was transported to dam site by conveyor belt at rate of 870 cu. yd. per hour. Upstream riprap was a 3-ft. thick blanket of basalt rock. —ENGRG. NEWS-RECORD

prevented rotation of the table until table had been magnetized. The relay cost $8.

To institute a safety program, indoctrination classes should be held, and these should include all foremen, assistant foremen, and set-up men. To operate effectively these men must understand the program and their jobs. Many department heads complain, after the institution of safety programs, that foremen spend too much time checking safety and too little time checking production. The balance between the two is fine and must be worked out between the department heads and the safety supervisor.—*From "Production With Safety," McGraw-Hill Book Co.*

PRODUCTIVITY INCREASED

A survey of 476 companies employing 1,070,420 workers reveals that from Jan. 1, 1946, to Aug. 6, 1947, productivity in the United States rose 5.3% while wages rose 23.5%. Factors causing rise of productivity were: better equipment, incentives or bonuses, improved factory methods, better skilled labor force, improved employee relations, and good management. Causes of decreased productivity, mentioned by one-sixth of the companies, were: postwar let down, labor-union troubles, and high labor turnover.

To improve productivity, factories suggested: better equipment and facilities, better worker attitude and efficiency, improved factory methods, better management and supervision, incentives and bonuses, scarcity of jobs, availability of materials, and reduced union influence over workers. —FACTORY

BELGIAN MINE OPERATES TRAINING SCHOOL

To increase interest in coal mining as an occupation, thus augmenting its working force, Charbonnages D'Hornu et Wasmes, Belgium, has instituted a vocational training school. Designed to recruit and train young men and to assure qualified miners, the operators built a full-size model mine on the surface with all equipment used in the mine, including forced ventilation. Coal seams are in place, inclination ranging from horizontal to vertical. Three working faces are available for training. Roof of the model is supported by typical mine timbering.

Four courses are given—preparatory, practical, theoretical, and mechanical maintenance. In addition to actual mining courses, mathematics, language, and other general courses are offered. Preparatory course takes 1 yr.; practical, 2 yr., consisting of actual work; theoretical, 3 yr., working toward mine foreman's rating. —COAL AGE

NEW PAKISTAN FACES BIG MODERNIZATION JOB

Pakistan, the world's newest and fifth largest country, already is planning its industrial future. But the country is without modern industry and does not have accurate estimates of natural resources. Foreign capital is needed; government officials are seeking a 70-30 ratio of domestic to foreign investment. Some private businesses offer 45% interests to foreigners for investment of capital goods, patents, and know-how.

Eastern Pakistan's economy, for the present at least, will be based on jute, the area controlling 85% of all former India's crop. Previously, jute represented 25% of all of India's exports. Needed are presses to bale the crop and machines to convert it into jute cloth. Western Pakistan appears to have an excess of cotton, producing about 1,000,000 bales annually of long staple. Annually the area has a 1,500,000-ton grain surplus.

Chittagong, 200 miles east of Calcutta, will be built into Pakistan's major port; an alternate will be built in the eastern area. The province of Sind 5-yr. plan calls for government construction of standard factory sites, buildings being constructed in multiples of 4,000 sq. ft. Government-built factories will include water systems, power mains, and railroad sidings.

In western Pakistan, the Indus River will be dammed 100 miles up stream to provide irrigation for 2,000,000 acres of rice land. The dam will cost $18,000,000; the canals, $12,000,000. —BUSINESS WEEK

SAFER SHIPMENT—Steel gates, on upper and lower sections of freight car walls, can be closed together and locked, forming bulkheads and dividing car into compartments. Steel and wood shelves fit on lower gates, supporting upper tier of freight. Gates and shelving permit use of previous waste space in shipments of less-than-carload lots. Pennsylvania R.R. is building 100 cars equipped with gates and shelving; cars will be 60 ft. long, one-third larger than standard freight cars. —BUSINESS WEEK

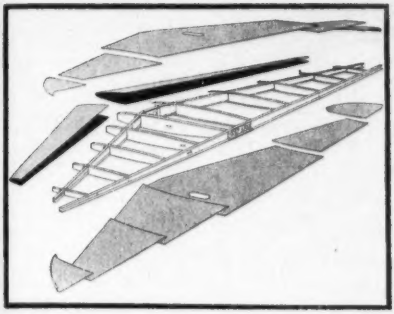
DAM FACE GROUTED WITH RESERVOIR FULL

Some 13,000 cu. yd. of gravel backfill was grouted against the hydrostatic pressure of a full reservoir in finishing the new upstream face on the rebuilt Baker Dam. Grouting was done from dam crest through slotted riser pipes embedded as gravel backfill was placed.

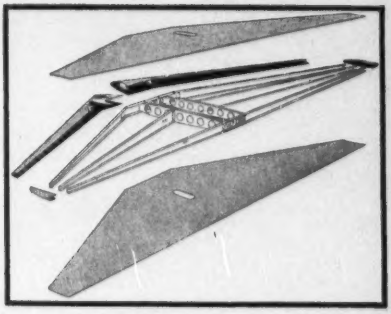
Grouting was mixed in central plant and pumped into header pipes extending full length of dam crest. These pipes discharged into hoppers of air-driven grout pumps which forced grout through hose and into the risers. Pumping through all risers was simultaneous to keep grout at same general level throughout backfill area. —CONSTRUCTION METHODS

FORD FREEZES DIES

Dies used by Ford Motor Co. for forming sample parts are alloys of bismuth, tin, and lead. To keep this soft alloy from losing shape, the dies are frozen in liquid nitrogen to −320° F. Dies will withstand 6 to 10 stampings before refreezing is required. —BUSINESS WEEK



1 BEFORE being redesigned, stabilizer had 2 spars, 10 ribs, and 13 skins.



2 AFTER redesign, stabilizer has 3 spars, 6 ribs (4 in nose), and 6 skins.

Designs Low Cost into Plane

Major changes in wing and empennage design save up to 50% in materials, and lower assembly time as much as 75% to permit low price

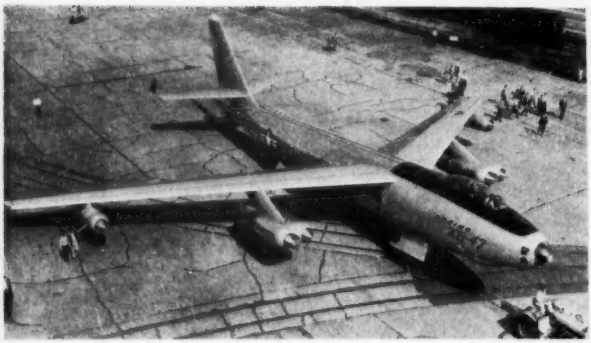
Lower manufacturing cost has been engineered into the redesigned all-metal, two-place, 65-hp. Luscombe *Silvaire* personal airplane. As a result, it now sells at $2,495, very near the price of the most inexpensive fabric-covered two-place planes.

Economy in production is achieved through three main channels: (1) Breaking down assemblies into subassemblies for greater fabrication efficiency. (2) Eliminating direct load carrying components when this can be done by increasing the gage of material in a structure without detracting from the load capacity of the finished unit. (3) Extensive use of available automatic machines, particularly riveters and spot welders.

Other factors considered are the use of low-density materials such as magnesium alloys for primary structures; attention to design details, such as elimination of left- and right-hand parts where possible, combination of parts to minimize number for each assembly; relaxing tolerance on parts where close tolerances are not essential; and overall coordination of design with production, so that tools, jigs, and production scheduling will be taken into consideration in the design.

Simple Wing—New wing, composed of nine panels and of all-sheet metal construction, costs 18% less than old fabric-covered wing. Assembly time is 10% less. Extensive use of subassemblies permits use of automatic riveters on four-fifths of all rivets in wing. The two spars are extruded from corrosion resistant 61 ST alloy because of lower initial cost. Wing formers are cut from strip stock and fabricated on a single-operation die. Joints are riveted, eliminating need for close-tolerance holes or matched hole patterns required for bolts. Wing tip is fabricated by drawing a single sheet, and is attached to wing by rivets at the periphery. Single wing struts replace conventional welded, double-wing struts with jury struts. The new struts, formed from heavy sheet, have identical fittings riveted into each end for attachment to wing and fuselage, eliminating right- and left-hand strut assemblies.

Changes in Fin—Redesigned fin re-



630-MPH. BOMBER—Latest in bomber design is incorporated in Boeing Aircraft Co.'s XB-47. Drag-alleviating sweptback wings are the first used on combat planes. Six turbojets produce 24,000 lb. thrust; four inboard engines are suspended in pairs below wing to bring center of gravity forward. Fuel for 2,000 mi. is carried in fuselage. Rockets assist takeoff. Span is 116 ft.; length, 108 ft. —BUSINESS WEEK

quires only 1½ man-hr. to assemble compared to 3½ man-hr. for old fin. It is composed of two spars, one rib, and three skins, compared to two spars, four ribs, five skins, and one casting for old fin. It cost about 50% as much to make. Spars and skins are formed on standard brake dies. Reinforcement is provided by folding the two main skins and riveting them together to make a load-carrying perpendicular joint at middle of fin.

Stabilizer Redesigned—New stabilizer uses three spars, two ribs and four nose ribs (three separate parts), and six skins (three parts) compared to two spars, ten ribs (five parts), and thirteen skins (seven parts) in old unit. Design eliminated 400 rivets, cut cost 30%, assembly time, 70%. Both stabilizer and fin are of all-sheet metal construction, with no welding, no machined parts, no right- or left-hand parts. —AVIATION WEEK

OUTLOOK FOR TIN

Normal tin production in Netherlands East Indies will be restored by 1949, and in Malaya and Siam, a year later, according to Sir John Bagnall, retiring chairman and managing director of Straits Trading Co.

Half the world's needs for tin could be supplied by British Malaya provided prewar capacity is restored, another authority predicts. Pincipally because of lack of coal for power, the position in Malaya has worsened since last December. Aside from present political and economic upset, the tin industry is in good position. —ENGRG. & MINING JL.

SPECIALIZED FACTORY WITH ADVANCED FEATURES

What the specialized postwar factory building should be like is illustrated by Winthrop Chemical Co's new pharmaceutical packaging plant. This completely sealed building has glass-block panels to admit some natural light and avoid a shut-in effect. Outside air enters only through the air-conditioning system and is cleared of dust by electrostatic precipitators and irradiated by bactericidal lamps.

Electrical and other facilities are built in. Suspended ceilings allow space for electrical distribution and piping, as well as ventilating ducts. This arrangement also allows for recessed fluorescent lighting fixtures, glass-enclosed and flush-mounted to afford minimum dust-collecting surface and provide lighting intensity of 30 ft.-candles.

Working spaces can be held to 77°F. dry bulb, 65°F. wet bulb, in summer under automatic control. Silica-gel units keep certain processes to a relative humidity of 25%. —ELECTRICAL WORLD

IMPROVEMENTS COMING IN RAILROAD EQUIPMENT

With the warborne pinch in materials lifting, railroad freight and passenger car manufacturers are planning improvements to speed service, increase comfort, and cut costs. Many such improvements were on display at the recent Railway Supply Mfg. Assn. exposition. Trend is toward lightweight, high-speed equipment and mechanical handling of freight.

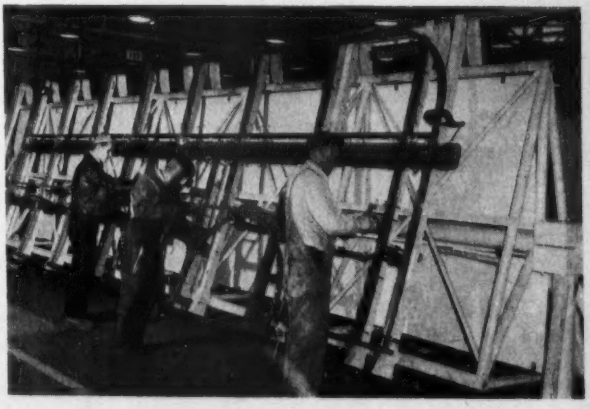
A new brake design which works with current braking equipment is the load-compensating system, important to lightweight freight cars. With the new system, braking power is increased automatically on heavy cars, resulting in greater safety and shorter stops for loaded cars. Cars built of low-alloy tensile steel or aluminum provide better weight-load ratios—an aluminum coal car carries 6½ tons more coal than the standard car of the same size.

Installed in any standard journal box, a new oil feed insures clean oil on the bearing because a wool surface fed by woven-in wicks acts as a filter. Another journal box development, adaptable to current freight cars, has two double-row, self-aligning spherical roller bearings. In another, the inner race is shrunk on the journal, becoming a part of the axle. With the inner race separable from the bearing, journal box and roller assemblies can be removed by hand from the axle.

Speeds up to 100 mph. will be possible with a new cast 4-wheel truck for refrigerator cars. One freight truck permits fast wheel change and has a built-in friction device controlling spring travel. Compressed-air cushions will supplement car-spring action, acting as an additional spring and as a rebound snubber. Direct-action hydraulic shock absorbers, similar to those for passenger cars, will be used. —BUSINESS WEEK

BRITISH AGAR PROCESS

Improvement in production of agar-agar from seaweed has been made in Britain. An aqueous extract is obtained by boiling seaweed in weak calcium hydroxide solution, separating resulting liquor, and subjecting this to heat and pressure in an autoclave in presence of potassium hydroxide. Extract is changed into agar by neutralizing the solution with hydrochloric acid, decolorizing the neutral liquid with charcoal, and then filtering the liquid. —FOOD INDUSTRIES



SPEEDS BUS BUILDING — Substantial reduction in man-hours for assembly of buses has been effected at Kenworth Motor Truck Corp. Major subassemblies—sides, ends, roof, floor, and chassis frame—are fabricated on rotatable jigs bent into shape on a plastic mock-up. Jigs permit workmen to position their work at most convenient level, are not affected by floor imperfections and vibrations. Construction of side of bus is shown. —WELDING ENGINEER

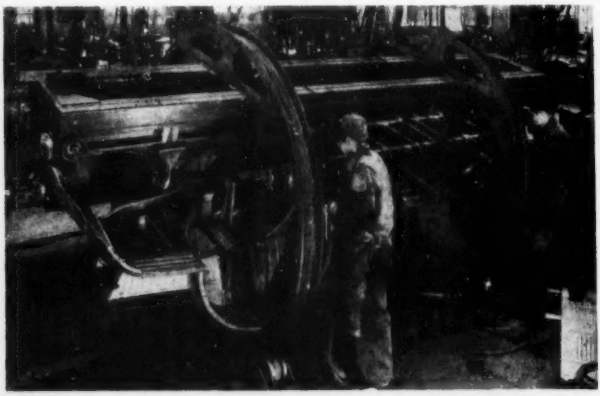
FRENCH AUTO

Bombed almost out of existence, French automobile industry is making

Not only is originality shown in designs for lightweight, economical French autos, but ingenious welding techniques have been introduced to facilitate fabrication. Pictures on these pages illustrate unusual designs and efficient production methods.

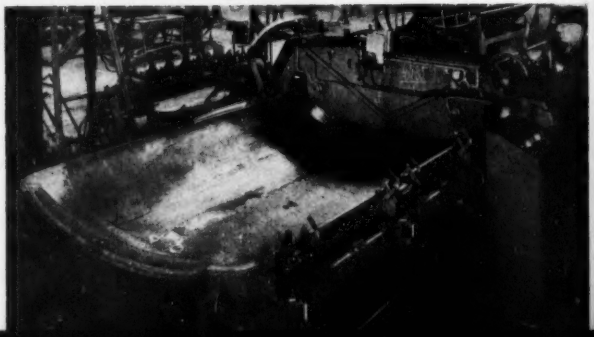
Renault, largest French auto maker, whose factory near Paris employs 30,000 workers, uses chiefly spot welds, supplemented by arc welding, to build 80 lightweight Juvaquartre cars daily. Each of these small automobiles has about 4,750

1 SIX-THOUSAND spot welds are made in fabricating the three-wheel Mathis aluminum automobile. Of monocoque construction, this three-passenger auto has total body weight of 850 lb., gets 65 miles per gal. There is no separate chassis, and every panel in the car, except hood and fenders, is a stress member. To meet the problems involved, the designers turned 100% to welding.



3 EASIER access for arc welding beams in chassis of both trucks and buses is provided by special turnover device at Chausson. Chassis-floor complex is assembled on dolly which is clamped to rails fastened inside two large "wheels." By turning wheels, any desired angle of attack for welding can be obtained. Here chassis is almost upside down.

4 SEMI-AUTOMATIC spot welder was developed at Chausson for joining roof panel to framework of stringers. Assembly is clamped to copper-plated form, above which rides a movable welding head with two electrodes which are carried by chain drive along crosswise stringers. When one stringer is finished, head is moved to next.

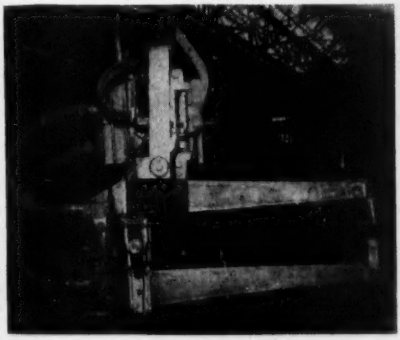


INNOVATIONS

dramatic comeback. Ingenuity is displayed in design and fabrication

spot welds. An all-welded bus with 44,000 spot welds is made by Societé des Usines Chausson. The same firm is producing an all-welded 1½-ton delivery truck, using 10,500 spot welds, plus several long automatic arc welds. Chausson has developed guns with the transformer above the pincers to reduce conductor current loss. The company also is investigating high-frequency welding. Using 200-cycle current, a unified transformer pincers for spot welding weighs but 18 lb. —WELDING ENGINEER

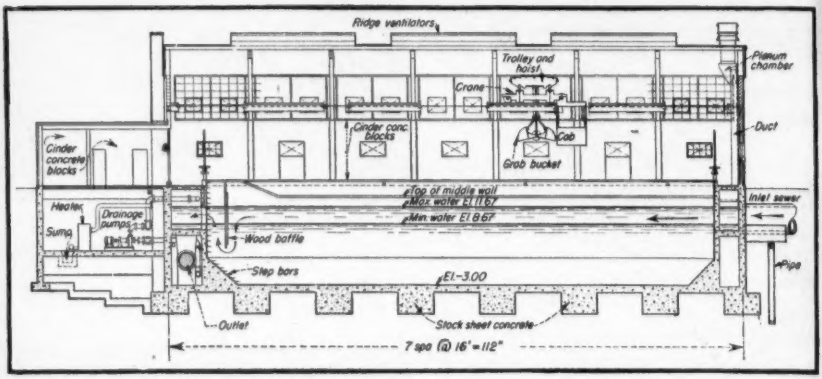
2 NOVEL spot-welded construction also is used in two aluminum racing cars built by Deutsch & Bonnet. Chassis consists of 2-mm. aluminum sheet formed into box shape and welded (6). Body also is spot-welded aluminum. On cross-country run, car operated 26 miles per gal. at average speed of 65 mph.



5 GIANT welding gun of new design and with 45-in. throat is used in truck assembly at Chausson body plant. Gun carries transformer right above pincers, avoiding 90% of current loss caused by the conventional long welding cables.

7 FLOOR ASSEMBLY of Mathis car (1) is spot welded. The smoothness of surface obtained from spot welding is evident.

6 CHASSIS for Deutsch & Bonnet racer (2) weighs only 45 lb. It consists of 2-mm. aluminum sheet formed into a box shape and spot welded.



CUTS SEWAGE COST—Sewer maintenance costs and river pollution will be reduced with the installation of this grit and grease chamber at Salem-Peabody, Mass. Previously, city sewers became so lined with sediment that they could not accommodate necessary load. Now sewage will pass through two channels detaining sewage—filled with grease and solids from local tanneries—for 22.5 min. at average rate of flow of 11.5 mgd. Channels are 99x16x14 2/3 ft. Grease and grit are retained by baffle at outlet end. For cleaning, one channel will be shut down. Grease and grit will be removed by ½-cu. yd. clam-shell bucket on overhead hoist, dumping into trucks on channel-side ramp. The unit will cost approximately $210,000.—ENGRG. NEWS-RECORD

LARGE 2-POLE GENERATORS PROVE THEMSELVES

During the past decade, the two-pole generator for large power-station ratings has proved itself. Efficiency, reliability, and suitability for operating conditions compare favorably with units for 1,800 rpm. The smaller and lighter rotating parts of the 3,600-rpm. turbine and generator greatly facilitate manufacturing, installation, and maintenance operations. At present, single-shaft, 3,600-rpm. generators for ratings up to 80,000 kw., or 100,000 kva. at 0.8 power factor, and 90,000 kw. or 105,000 kva. at 0.85 pf., are being built.

Problems of double-frequency vibration in motor has been solved. Uniform rigidity in the plane of the poles, and at right angles to them, is obtained by transverse slots machined into pole faces. Double-frequency vibration of stator core is reduced by rigid cores, the laminations being tightly clamped together so that the built-up body functions as a solid cylinder. Transmission of vibrations from stator core to housing has been made negligible by flexibly supporting the stator core relative to the frame housing.

Hydrogen now generally cools all two- and four-pole turbine generators rated at 20,000 kva. and over. —POWER

SOVIET FOOD PROSPECTS

Russia's 1947 grain crop is so abundant that officials hope to abandon bread rationing prior to 1948. Food processing industry output should be increased over last year. There are 186 sugar refineries in operation to handle sugar beets from 400,000 acres. During the summer, new equipment was put in operation for the extraction of vegetable fats and oils. Margarine production will be quardupled. Although vegetable production is down, food canneries hope to increase output 10% over 1946. —BUSINESS WEEK

NEW GRIEVANCE PROCEDURE KEEPS WORKERS HAPPY

By introducing a common-sense procedure for handling employee grievances, Gerber Products Co. reduced complaints from a high of fifteen a month to four in six-months. Analysis of grievances showed that inconsistent interpretation and administration of plant rules was the big trouble. Lack of effective methods of locating troublesome situations before they developed into serious trouble was another major fault. The third weakness was a rather definite gap in relationships between foremen and union stewards.

First step was to sit down with the foremen group and evaluate soundness, fairness, and workability of shop rules, outdated rules being eliminated. The degree of penalty to be applied for infraction of each rule was restudied. Then the plan was presented to union stewards, and their approval obtained. When it was introduced, the program was explained through foremen and employees' educational media, such as the handbook, house organ, and bulletin boards.

To provide a record on which a foreman can base disciplinary action, discipline warning slips are sent to the personnel department, where a card file is kept for each employee who is given one or more slips.

The preventive phase of the plan is designed to reveal little grievances and strengthen daily contacts between foreement and employees. It involves:

1. Improving effectiveness of the in-plant, follow-up, induction interview. Interviewer looks for little complaints that enter conversation about a man's job. Attempt is made to influence the man to take his complaint to his foreman. In any event, every complaint is followed up.

2. Increasing the number of contacts between foremen and individual employees, including stewards. Through a few meetings, management was able to convince each foreman that the employee's inclination to bring minor complaints and questions to him depended on the relationship between the two of them.

3. A new rating form was designed to help foremen to discuss the employee's performance more specifically. Such matters as horseplay and absenteeism were given a place in ratings and shop rules.

4. Management agreed to hold group meetings with the union bargaining committee. The intent was to reduce misunderstandings by advising the committee of changes or to provide other new information. This proved to be an excellent channel through which to resolve problems and complaints that hadn't yet developed. At every meeting some little troublesome situation has been uncovered.

In addition to solving the grievance problem, these methods have done much to develop mutual worker-management trust and confidence—the real key to industrial peace. —FOOD INDUSTRIES

PHONE WITH VISION—Videotelephone, comprising small television set combined with telephone apparatus, has been built and installed at U.S.S.R. Television Research Institute. Viewing screen shows the person at other end of line. —ELECTRONICS

BOUNDARY-LAYER CONTROL MAY IMPROVE AIRCRAFT

Tremendous gains in aircraft performance and flight safety soon may be available through control of the boundary air layer (next to plane's surfaces). Among advantages forecast are: (1) Possible 25% speed increase in certain designs. (2) 100% increase in lift. (3) 32% reduction in fuel consumption. (4) Reduction of stall tendencies. (5) Improvement in transonic stability. (6) Increased rate of climb and higher ceilings. (7) Much shorter takeoff and landing distances.

In addition, boundary-layer control offers a means of airplane control involving none of the adverse effects of present systems, improves flight characteristics, and solves the principal problem of the flying wing. Research data now available will permit the aerodynamic design of boundary-layer control wings, control surfaces, and complete airplanes.

Final obstacle is development of efficient mechanical systems to suck the boundary layer air down into wing through slots, or to pump a jet of air into boundary layer, or a combination of the two. Tests have indicated that pumping is more beneficial but requires 3-4 times as much power. —AVIATION WEEK

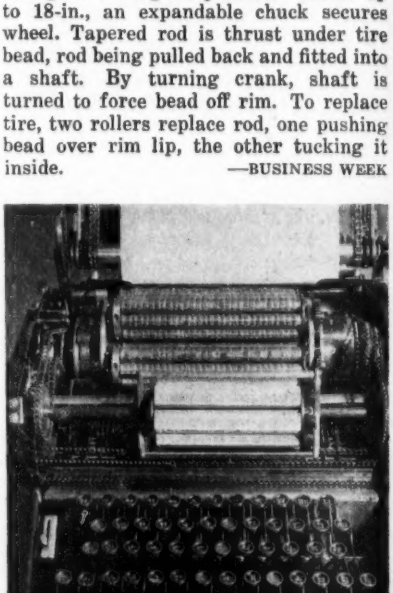
STOCK MOVED ON WHEELS

Almost everything at Central Hardware Co. is moved on wheels, reducing handling and selling costs and raising profits. Thirty trucks, mostly 4-post, with center wheel and four casters, and 25 wheeled tables are used. A power fork truck soon will be added. The 7x31x34-in. wheeled table, designed and built in the store, has proved most efficient for handling small merchandise.

When merchandise arrives at receiving department, small merchandise is placed on table, smallest pieces on top, larger ones on shelf below. Tables are wheeled to elevator and then pushed to pricing section. From there tables move to storage where merchandise is stored in bins. All large items are stored on pallets. —MILL SUPPLIES

CHANGES TIRES QUICKLY

Tires can be changed in 30 sec. with the Mercury Mfg. & Equipment Co. tire changer. Taking drop-center wheels up to 18-in., an expandable chuck secures wheel. Tapered rod is thrust under tire bead, rod being pulled back and fitted into a shaft. By turning crank, shaft is turned to force bead off rim. To replace tire, two rollers replace rod, one pushing bead over rim lip, the other tucking it inside. —BUSINESS WEEK



TYPES CHINESE—Able to print 90,000 Chinese characters, this typewriter, invented by Lin Yutang, Chinese author, has 72 keys. Two upper banks control top and bottom sections of the characters. By pressing an upper and a lower key, eight characters appear above keyboard; operator selects desired character and presses proper numbered key (white bank) at bottom to make impression on paper. Machine also types English, Japanese, and Russian. Previous Chinese typewriters typed a maximum of 5,400 characters. —BUSINESS WEEK

New Radio Transmitter

New tubes and new circuit techniques are used in successful new 50-kw. transmitter for 100.5-mc. frequency modulation broadcasting

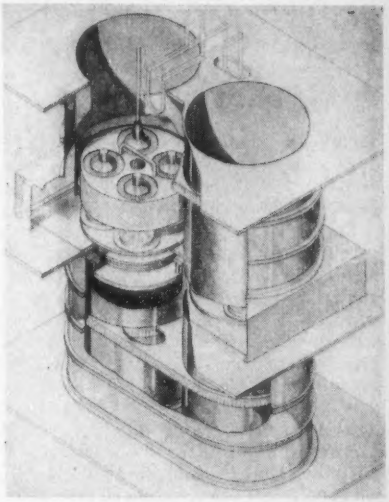
Operating experimentally on 100.5 mc. since April 23, the 50-kw., high-band, frequency-modulated radio transmitter of station KSBR is nearing commercial perfection. Successful development of this transmitter required new tubes and new circuit techniques.

Starting from a dual-channel phase-shift modulator and a frequency multiplier chain, the transmitter requires only three air-cooled stages to reach the 50-kw. output. These are a 3.5-kw., a 13-kw., and a 50-kw. stage.

The 3.5-kw. stage will use four 4X500A's in a push-pull arrangement driven directly from the 829B output stage of the exciter unit. The cooling system is unusual, and is similar to those in the other stages. Air enters each tube cooler from the base end and exhausts through the anode lines, the incoming cool air passing over the glass between adjacent electrode seals, as well as over the seals themselves.

As a second amplifier, a pair of 3X2500A3 air-cooled triodes is employed in a grounded circuit and operates push-pull. Two-conductor cathode and anode tank circuits have high surge impedance, and the cathode tank circuit is quite short at the high-frequency end of the f-m band.

The 50-kw. final amplifier uses a pair of 3X12500A3 triodes in a grounded-grid circuit. These tubes are new multi-unit thoriated-filament triodes. They consist basically of four units of the 3X2500A3 type assembled on a common mounting. Low-inductance disks interconnect the filament and grid terminals of the four units. The cathode tank circuit of the amplifier consists of two 12-in. dia. sheet-copper conductors on 14-in. centers, these being enclosed by an oval shield ½ in. from the conductors.



Cut-away drawing of final r-f amplifier stage of successful 50-kw., 100.5-mc., f-m radio transmitter. Anode tank circuit is at top; cathode, at bottom. Loopr (at top) couple anode tank circuit with antenna transmission line.

Tuning is accomplished by changing the position of a shorting plate which contacts the two tank conductors and the shield.

Dividing the amplifier into two sections is a 36 x 24 x ⅛-in. aluminum alloy plate which serves as an isolating shield between cathode and anode circuits.

The anode tank circuit is similar to the cathode tank circuit, except that spacing between conductors and shield is 1 in. At resonance, the cathode tank circuit is approximately ¼ wavelength long; the anode tank circuit, slightly over ½ wavelength long.

Power is taken from the anode circuit

by means of two loops which enter from above and project through slots in the shorting plate into the field around the conductors. The loops are connected in parallel at their upper ends and feed an open-wire transmission line leading to the antenna. These loops can be moved up or down to adjust amount of coupling to anode circuit. —ELECTRONICS

VITAMIN-RICE PROCESS

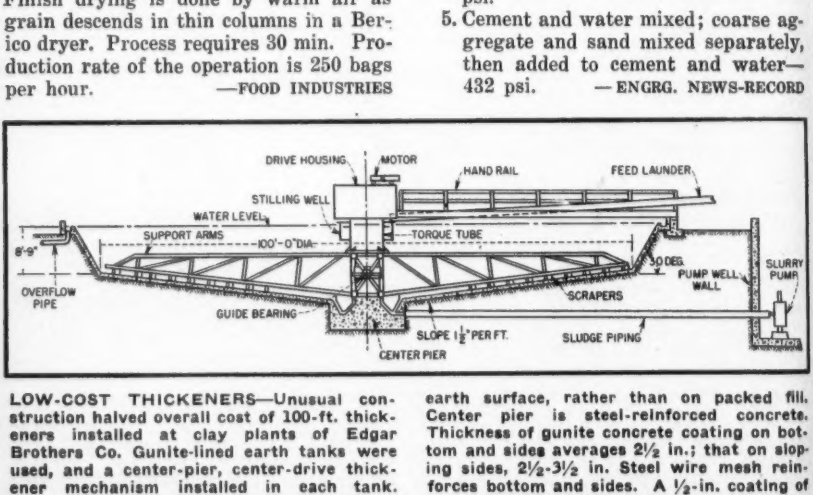
To improve nutrient value of rice, impart a new flavor, and make the grain more resistant to weevil attack, the Malek process is used by Rice Growers Assn. of Calif. To transfer water-soluble nutrients from hull and bran into grain, California Pearl rice is steeped in hot water and later exposed to heat and steam pressure while being agitated in a rotary steamer. It moves by gravity to decompression chambers where, in 7 min., the pressure is reduced gradually so grains will not burst. A rotary unit then dries it and reduces temperature to 140°F. Finish drying is done by warm air as grain descends in thin columns in a Berico dryer. Process requires 30 min. Production rate of the operation is 250 bags per hour. —FOOD INDUSTRIES

ORDER OF MIXING CONCRETE AFFECTS TENSILE STRENGTH

Order of mixing ingredients of concrete has a definite effect upon tensile strength, according to tests conducted by Rocla, Ltd., Melbourne. Tests show that tensile strength is increased 11% when fines and cement are mixed dry, the water added, and then coarse aggregate —rather than when water is added last. A drum-type mixer should not be used for first mixing method.

Tests of different mixing sequences showed tensile strength after 28 days to be:

1. Sand and cement mixed; water added; coarse aggregate added—664 psi.
2. Sand and aggregate mixed dry; cement added; water added—598 psi.
3. Cement and water mixed; sand added; coarse aggregate added—548 psi.
4. Cement and water mixed; coarse aggregate added; sand added—471 psi.
5. Cement and water mixed; coarse aggregate and sand mixed separately, then added to cement and water—432 psi. —ENGRG. NEWS-RECORD



LOW-COST THICKENERS—Unusual construction halved overall cost of 100-ft. thickeners installed at clay plants of Edgar Brothers Co. Gunite-lined earth tanks were used, and a center-pier, center-drive thickener mechanism installed in each tank. Tanks are excavated in all-clay ground free of stones. Concrete was applied to original earth surface, rather than on packed fill. Center pier is steel-reinforced concrete. Thickness of gunite concrete coating on bottom and sides averages 2½ in.; that on sloping sides, 2½-3½ in. Steel wire mesh reinforces bottom and sides. A ½-in. coating of Alumnite was sprayed on for acid resistance. —ENGRG. & MINING JOURNAL

GLASS-BLOCK PANELS WILL CONTROL LIGHT

New prismatic glass building blocks direct light to ceiling for reflection toward floor. More uniform light distribution is achieved, and shading devices are not necessary. To get full benefit from daylighting of a room with glass blocks, ceilings should have high light reflectivity; glass area must be adequate; head of panel should be as far above the floor as possible.

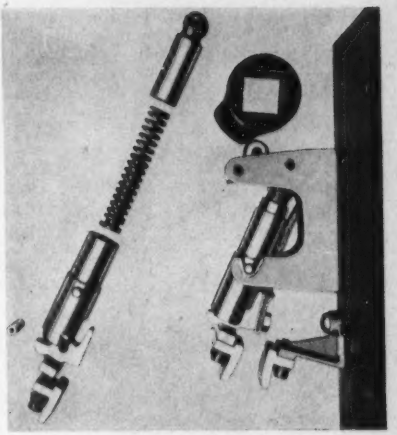
Insulating value of glass block is high, heat loss being equal to that of an 8-in. plaster wall in winter. Smooth-faced blocks transmit only 40% of the solar heat passed by single-glazed windows in summer. Light-directing blocks transmit even less.

Without intermediate supports, glass-block panels should not exceed 144 sq. ft. Intermediate mullions or horizontal shelf angles of structural steel can be used to reinforce larger panels. Panels require framing similar to that for windows. —ENGRG. NEWS-RECORD

NEW PROPELLER PROBLEM

Propeller-blade stresses of significant magnitude can be caused by the newly discovered "one P" vibration or "first propeller order excitation," particularly in large propellers. Under study by Hamilton Standard, the problem is this: The force on the blade varies as angle of attack. If there is an angle of inclination between thrust line and airstream (as in climb), the propeller will operate at a varying angle of attack, subjecting the blades to fluctuating forces during each revolution. Angularity between airstream and propeller disk is aggravated by upflow induced by wing.

New propeller designs and locating propeller well forward of wing, in some cases tilting propeller downward from wing chord line, are possible solutions to the problem. —AVIATION WEEK

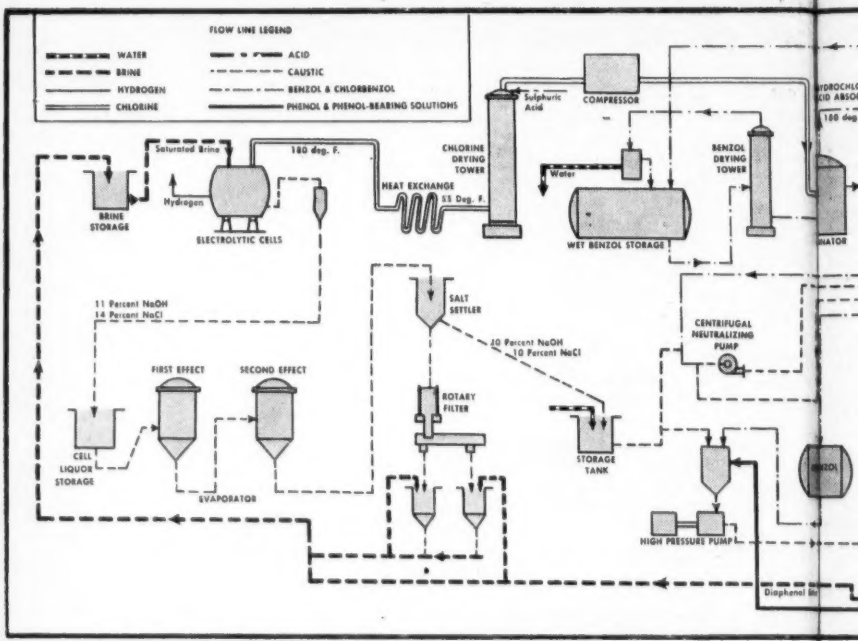


BETTER CONTACT DESIGN—Greater current capacity and faster positive action are designed into new electric truck controller by Elwell-Parker Electric Co. Unit has nine "trigger fingers," each comprising a trunioned tube housing a spring enclosing a plunger. Cam follower compresses, then releases, spring which controls pressure of plunger. Tip of finger's contact instantly is rocked against tip of fixed terminal. Toggle action then rocks contact under firm pressure. First and final contact is at tips, protecting contact surfaces. Heavy currents are in make or break under magnetic blowout. —ELECTRICAL WORLD

WRINKLE-PROOF FABRICS

Using Resloom C, a Monsanto Chemical Co. resin, Dan River Mills, Inc., has developed a process to wrinkle-proof cotton fabrics. All previous wrinkle-resistant chemicals have reduced tensile strength of cloth, but Dan River claims effect of the new resin on material is negligible. The resin permeates the fibers, not merely coats them. The wrinkle-resistant quality improves with age and use.

Fabrics had to be completely "redesigned" before process could be applied. The resin has been applied successfully to cotton chambray, gingham, plaid shirting, and cotton tweed. —BUSINESS WEEK



Flow sheet of continuous process for production of synthetic phenol from monochlorbenzol.

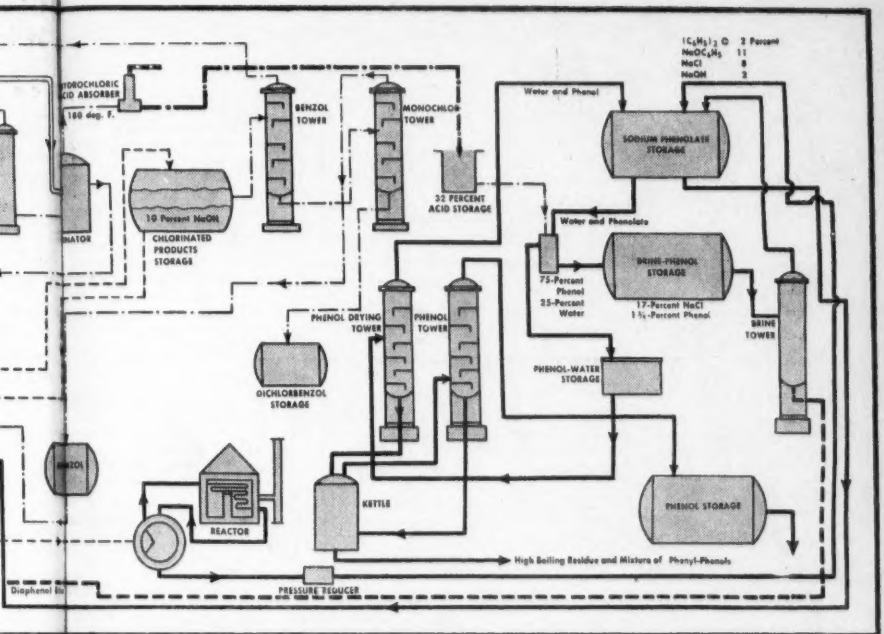
Continuous Phenol Process

Raw material for plastics is made in new General Electric plant using the most modern equipment and methods. Phenol is made from monochlorbenzol

Synthetic phenol is produced from monochlorbenzol by a completely continuous process in a new General Electric Co. plant of advanced design. Rock salt, the raw material for the electrolytic alkali-chlorine cells, is converted into brine and purified. Its temperature is raised to 150°F. in heat exchangers and the solution resaturated with salt. After reheating, it goes directly to Hooker-Type S electrolytic cells.

Caustic soda effluent from the cells is evaporated to 20% and the salt crystals separated. The caustic is then diluted to 10% and held for hydrolyzing the monochlorbenzol.

Chlorine leaves the electrolytic cells through a chemical stoneware pipe and is cooled from 180°F. to 55°F. in a glass heat exchanger. The gas is then dried in stoneware towers by allowing sulphuric acid to come in intimate contact with it in countercurrent flow. After drying, the gas is compressed to 20 lb. and goes to the chlorinator, a cast iron kettle. Here it comes in contact with benzol dried by distillation and pumped continuously to the chlorinator. The



benzol is chlorinated to a ratio of 14 parts of monochlor to 1 part of dichlor with an excess of benzol slightly below the boiling point of the benzol.

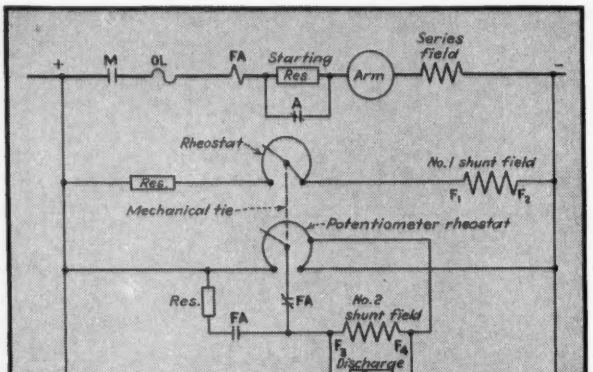
Gases leave the chlorinator at 180°F. and are cooled in a shell-and-tube heat exchanger made of brass and Hastelloy B. Cooled gases are absorbed in water to form 32–33% hydrochloric acid employed to neutralize sodium phenolate in the formation of phenol.

Acid is stored in rubber-lined steel tanks or in concrete tanks lined with brick and sulphur-base cement. For acid lines from the absorber to the tanks, porcelain, glass, and Haveg have been found satisfactory.

Liquid leaving the chlorinator is 55% unreacted benzol, 42% monochlorbenzol, and 3% dichlorbenzols. It is neutralized with 10% caustic in a high-speed centrifugal pump, and the components separated.

Monochlorbenzol and from 10 to 15% caustic in the mol-ratio of 2–2½ to 1 are added continuously and mixed in the emulsifying tank. In the same tank is mixed the dephenyl ether which forms as a byproduct in the reactor. The mixture is compressed to 4,000 psi. In a carbon-molybdenum steel heat exchanger, the mix temperature is raised to 500°F., and the mix goes to the reactor. The feed first enters the radiant section of the tubular reactor and is brought to reaction temperature. In the convection section it is held at that temperature until the reaction is complete. Substantially all monochlor is reacted to sodium phenolate, diphenyl ether, or high boiling residues.

From the reactor the mixture is cooled



VARIABLE - SPEED MOTOR — With two magnetic circuits and a two-circuit armature winding, a speed range of 8 to 1 in a dc. motor can be attained by field control. Shunt fields, F_1-F_2 form main field. Second shunt fields F_3-F_4, on separate poles, serve as variable field. Both fields are changed simultaneously, the first from full to 60%, the second, from full in cumulative direction through zero to that value of current in opposite direction. —PRODUCT ENGRG.

and its pressure reduced to atmospheric, then the diphenyl ether (about 2%) is decanted from the sodium phenolate. The sodium phenolate is continuously neutralized.

This reaction forms a brine layer and a phenol-water layer. The former contains about 17% sodium chloride and 1½% phenol. The phenol in the brine layer is recovered by distillation. Water-phenol comes off the top of the tower and goes to the sodium phenolate storage tank. The phenol-water passes to the continuous distillation tower. All water and the small volume of phenol go off overhead to the sodium phenolate storage tank. The bottoms product is the dry phenol and high-boiling residues. These pass to the batch kettle of a phenol tower, which operates continuously until the residue must be drained. Pure phenol goes off overhead to the steel storage tank. —CHEMICAL ENGRG.

NEW PRINTING EMULSIONS

For printing with azoic, chrome, and direct color dyes, new emulsions in which the inner phase comprises the water-soluble, textile coloring compound have been developed. These emulsions will simplify printing problems where pigment is applied by water-in-oil emulsion systems. No starches or gums are necessary. Primarily, the emulsions have been used in printing, but they may be used to produce solid-dye shades. Preparation is similar to that of water-in-oil types for printing with pigment colors.

For preparation, a concentrated clear organic solvent, such as Varsol #2, and an aqueous solution of azoic, chrome, or other dye are mixed in an 8:22:70 proportion by weight. Printing is done on standard roller or screen equipment. The emulsions are developments of Interchemical Corp. —TEXTILE WORLD

Synthetic Fibers Gain

Rate of U. S. manufacture passes billion-pound mark. Production also is increasing in other countries. New Vinyon N characteristics announced

Use of synthetic yarns in United States textile manufacture has risen during 1947 to the billion-pound mark. Viscose rayon continues to be the most widely used synthetic, but the use of continuous-filament acetate yarns is increasing rapidly. Now used widely in the United States are: viscose, rayon acetate, cupra, nylon, azlon, vinylidene chloride, glass, Vinyon, and Plexon.

Newest entry in the synthetic field is Vinyon N, now being manufactured in "sample" commercial scale by Carbide & Carbon Chemicals Corp. Azlon, a relatively new synthetic yarn, is a protein-type fiber derived from casein, soybean protein, and peanut protein, or a combination of these. It is produced by Drackett Corp. and Sessions, Inc.

Much work is being done in other countries with such synthetics (in addition to those mentioned above) as: ardil, terylene, perlon, and rayolanda, but these fibers are not used in the United States.

Currently, United States textile manufacturers are importing synthetics heavily—in the first half of 1947, 24,000,000 lb. was imported, about 20% of the total production of Belgium, Norway, Sweden, The Netherlands, and Switzerland. Italy now is producing 66,000,000 lb. of filament rayon as compared with 3,300,000 lb. in 1945, and 37,400,000 of staple now as compared with 4,620,000 lb. in 1945.

Japan will, in 1947, produce about 17,000,000 lb. of filament and 20,000,000 lb. of staple; long-range plan is for a total annual production in Japan of 330,000,000 lb. of synthetic yarns. Plants for synthetic production now are being built in Latin America, Egypt, Australia, Greece, and Turkey.

The newest synthetic, Vinyon N, has a greatly enlarged cellular structure compared to Vinyon. Produced in four types —unstretched stabilized, stretched, stabilized Type H, and stabilized Type R— Vinyon N is a copolymer of vinyl chloride and acrylonitrile dissolved in acetone. This is filtered and then dry-spun by means of extrusion. Most types are stretched and twisted. Additional processes stabilize the fibers dimensionally.

With a specific gravity of 1.22–1.28, it absorbs water at the rate of 1% up to 95% relative humidity. Unstretched stabilized type shrinks at temperatures above 270°F.; stretched type, above 157°F.; Type H, above 248°; and Type R, above 275°. The last two types fuse at 338°F. None of the types will support combustion.

The fibers darken slightly after exposure to sunlight, with some loss in tensile strength; age has no effect on the

	Unstretched stabilized	Stretched	Stabilized Type H	Stabilized Type R
Tensile strength (gpd.)..... Std.	0.7 to 0.9	4.2 to 4.5	3.7 to 4.0	3.6 to 3.8
(Std. is 70° and 65% rh.)... Wet	0.7 to 0.9	4.2 to 4.5	3.7 to 4.0	3.6 to 3.8
Elongation (%)..... Std.	8 to 10	8.5 to 9.5	21 to 24	25 to 28
(Std. is 70° and 65% rh.)... Wet	8 to 10	8.5 to 9.5	21 to 24	25 to 28
Elastic recovery.....	100% at 0.5 gpd.	76% at 1.5 gpd.	100% at 0.5 gpd.	100% at 0.5 gpd.
Tensile stress (psi.).....	12,800	75,000	64,500	64,000
Average stiffness (gpd.).....	20 to 30	49	17	13
Average toughness {(g.cm.)} {(d.cm.)}	0.18 to 0.32	0.2	0.41	0.48

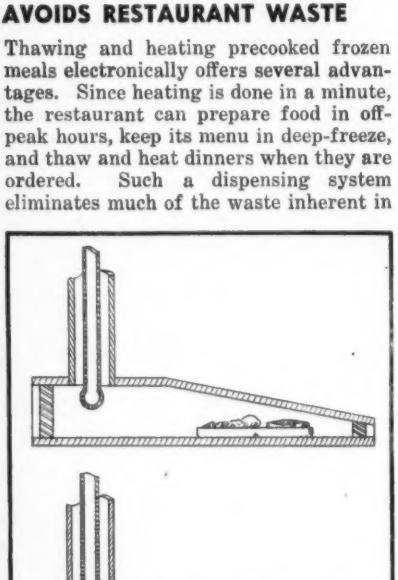
Tensile strength, elongation, recovery, stiffness, and toughness factors for the four types of Vinyon N fibers.

fibers. Stretched type is effected by 25% Chromic acid, 70% nitric acid, and 96% sulphuric acid; the other three types are resistant to practically all acids. Ferric chloride in high concentrations weakens all types.

Typical use for the fibers are: Unstretched stabilized—pile fabrics, rugs, felts, rope, some dress goods. Type H—dress goods, house furnishings, hosiery, foundation garments, linings. Type R—industrial filters, thread, paint-brush bristles. Stretched—fish lines, rope, dress goods. —TEXTILE WORLD

ELECTRONIC FOOD HEATER AVOIDS RESTAURANT WASTE

Thawing and heating precooked frozen meals electronically offers several advantages. Since heating is done in a minute, the restaurant can prepare food in off-peak hours, keep its menu in deep-freeze, and thaw and heat dinners when they are ordered. Such a dispensing system eliminates much of the waste inherent in present-day restaurant methods and saves daily losses suffered because the owner has to guess what his volume of business will be. Efficiency of the electronic heater is about 50%, or higher than that of conventional conduction methods.



More uniform heating is obtained in an electronic oven by tapering the cavity and food load, but this does not entirely solve the problem.

To avoid arcing between food masses, the heater frequency has been increased to 1,050-mc. with continuous-wave magnetron oscillator equipment developed by General Electric Co. This is about the upper frequency limit, because penetration difficulties are encountered at much over 1,000 mc.

Because the electrical characteristics of food in the frozen and unfrozen state are quite different, the overall impedance change in the electronic oven is a major problem. The heating cavity should be insensitive enough to impedance changes during the heating cycle to give a satisfactory impedance match and at the same time heat the food evenly. To obtain even heating, a tapered load and tapered cavity were tried, as were various types of cavities producing relative motion between the food and field. None was entirely successful. There also is a tendency for food that has thawed to absorb more than its proportionate share of energy, giving a "runaway" effect.

Tests showed that the greatest heating effect takes place at the point of voltage minimum in a wave-guide shaped cavity. So it was necessary to look at the problem from the viewpoint of relatively high circulating currents in the food.

Because the ratio of the electric vector to the magnetic vector in an electromagnetic field is dimensionally an impedance, it suggests that this ratio must be the right value for correct impedance matching into the food. This also hints the interesting theory that the heating of foods at this frequency may be considered to be more analogous to ultra-high frequency induction heating rather than dielectric.

To adapt the electronic heater to use by unskilled operators, the equipment

was made practically automatic. A power switch, a load timer (0–120 sec.), and a foot treadle are the only controls necessary. A 40-sec. time delay prevents use of the equipment until the tubes are heated.

As perfected, the electronic oven will handle a wide variety of precooked frozen dinner combinations with satisfactory uniformity. —ELECTRONICS

CYCLONE BURNER REPLACES CONVENTIONAL EQUIPMENT

Cyclone crushed-coal burners (McG-H Digest, March, p. 5) will be standard equipment on all new generating capacity of Commonwealth Edison Co., Chicago. The extremely efficient and compact equipment gets its name from the cyclonic manner in which coal is blown and circulated inside the burning chamber. The new burner supplants former methods of burning coal on a chain grate or in pulverized form.

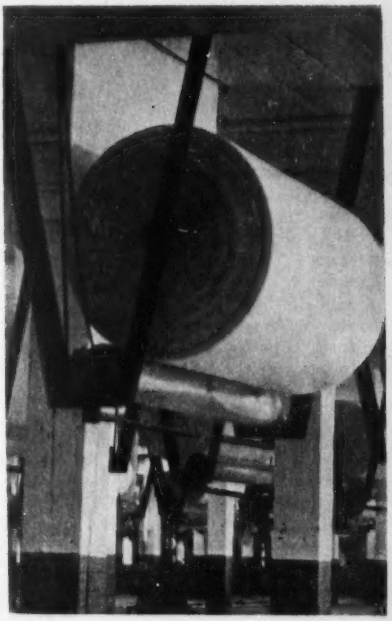
Chief advantages: (1) From 80 to 85% of the coal ash is collected in the furnace itself and removed in molten form. This materially simplifies ash handling and substantially reduces emission of dust through the stacks. (2) Boiler-tube cleaning is reduced, and more compact spacing of tubes permitted. (3) Costly precipitator equipment is not needed to remove fly ash. (4) Simple, easily maintained coal crushing equipment may be used instead of the more expensive pulverizers. —ELECTRICAL WORLD

HOW GLASS FIBER IS MADE

Fiberglas now is produced in more than 4,000 forms for hundreds of applications. Staple fiber is made from small glass marbles automatically fed to an electrically heated furnace. Molten glass discharges continuously through a spinneret. Directly below orifice, a high-pressure superheated steam jet seizes the molten threads and drags them downward, decreasing their diameters. The fibers pass a lubricating spray and a drying torch, strike a revolving drum, are directed through guides, then wound on tubes. After drafting and twisting, they are sent to weaving and textile fabrication.

In continuous-fiber process, steam jets are not used. Fibers from furnace are led through an "eye," then gathered, lubricated, and put onto high-speed winders. Strands are thrown into yarns.

In making glass wool, steam jets are used to stretch the filaments while in forming chamber. —CHEMICAL ENGRG.



REMOTE TAKE-UP ROLLS—Cloth woven on looms at Revolution Cotton Mills passes through slits in floor and is collected on take-up rolls on the floor below. This permits take-up rolls of greater diameter than the undercarriage of loom permits. Rolls are mounted at shoulder level, facilitating inspection. Filled take-up rolls are transported by lift truck. —TEXTILE WORLD

SMELTER FUEL COSTS CUT 40% BY NEW IGNITER

Fuel consumption has been reduced 40% on sintering machines in a Canadian lead smelter by a new charge igniter. It is a swinging burner hung on its air-supply pipe from bearings about 8 ft. above grates. It is oscillated across full width (42 in.) of sintering bed by a cam, and speed is proportional to forward travel of charge. Burner moves slowly across bed and returns quickly.

A leveling plate curves charge surface to arc of burner travel. This assures uniform air flow through charge, since it is deeper at edges where porosity is greatest. —ENGRG. & MINING JOURNAL

TROLLEY BUSES EFFICIENT

Planned maintenance procedure at Delaware Coach Co. has permitted the company to operate its fleet of 72 trolley buses at a 99.7% operating efficiency. Change over from street cars to trolley buses necessitated a long training program for maintenance personnel. So far as possible, men were retained on similar jobs.

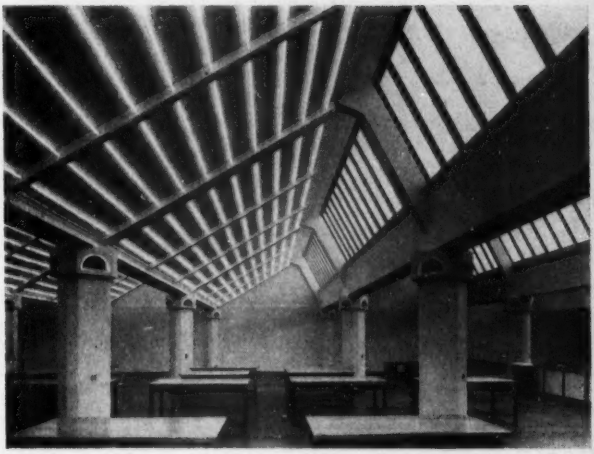
Complete inspection is made every 2,500 miles. Between major inspections, checks are made on brakes, air tanks, and lubrication system. Tires are checked weekly. Repairs to bodies, chassis, and electrical systems cost 2.52¢ per mile against 3.12¢ per-mile for gasoline buses. —BUS TRANSPORTATION

POTTERY MANUFACTURERS TURN TO MECHANIZATION

Pottery manufacture, long a handicraft industry, has turned to mechanization to cut costs and improve quality. Homer Laughlin China Co., largest pottery manufacturer in the United States, realized great savings from installation of materials-handling equipment. Now it is installing automatic jiggers to form flatware, buff uneven edges, dry china, and ready it for first firing. Three such jiggers are in operation. A machine and crew of three can turn out 240 dozen dessert dishes or 180 dozen dinner plates per hour. Four men produce 35–40 dozen per hour.

Mechanical dippers carry flatware through glazing spring and drying oven at a rate of 1,500 dozen per hour. Hand dipping would produce 800 dozen per day. Gold and silver lines can be applied

PACKAGED POWER—Ten 5,000-kw. packaged power plants will be built by Westinghouse Electric Corp. for Mexico and other countries. A recent development, the plant greatly simplifies installation of low-cost electric plants. Highly compact and standardized, it is completely self-contained, requiring only a building to house it. Either coal or oil can be used. —ELECTRICAL WORLD



SAWTOOTH LIGHTING—Ceiling-mounted on 18-in. centers, hot-cathode Slimline fluorescent lamps provide 75 footcandles in air-conditioned, engineering area of new Briggs Mfg. Co. building. Design permits replacement with cold cathode lamps. Skylights and lamps give inverted triangular trough of combined natural and artificial light. Looking toward skylights, no lamps are visible; in opposite direction, few lamps visible do not "stack up." —ELECTRICAL CONST. & MAINT.

mechanically at a rate of 300 dozen per hour against 200 dozen a day by hand. Pitchers, gravy boats, and similar pieces cannot be formed on jiggers. T. S. & T. China Co. is now working on a machine that will cast such pieces in sections.

Allied Engineering Co. has developed a new burner system for kilns reported to reduce fuel costs 25%.—BUSINESS WEEK

IRISH KEEP BREAD LONGER, MAKE SEAWEED JELLY

In Ireland, keeping quality of bread and confections has been improved by distributing a small quantity of mineral, vegetable, or animal wax throughout the flour or dough. This wax is mixed under heat with pharmaceutical paraffin oil, animal or vegetable oils, fats, glycerine, or lecithin. Flour is added when temperature is reduced below 212°F. Then material is cooled and powdered. For 10,000 parts of flour, the requirements are 28 parts paraffin or vegetable oils, 56 parts paraffin or beeswax, 2 parts margarine, and 269 parts bread flour.

Ireland also has developed a process for making table jelly and marmalade from seaweed. The seaweed is dried and washed with citrus fruit for 24-100 hr. to convert it to semi-gelatinous form. Sugar and pulped and sweetened citrus fruit then are added. —FOOD INDUSTRIES

HIGH-HEAT PORCELAINS

All-crystalline porcelains having exceptional mechanical and dielectric strength at temperatures up to 2000°F. have been developed by National Bureau of Standards. Their composition is characterized by such materials as alumina, beryllia, zirconia, and thoria, with minor additions of other oxides and by the absence of silica. A representative high-beryllia porcelain contains 84% beryllia, 8% zirconia, and small amounts of lime and alumina.

All of the compositions are highly resistant to deformation or creep up to 1800°F. for long periods. They are particularly suited for electrical, spark plug, and radar-transformer insulators.

High-temperature ceramics promise to be useful under temperatures at which the metallic alloys are not considered serviceable. —PRODUCT ENGRG.

TECHNICAL SHORTS

Air Cools Furnace Wall—Furnace-wall life has been extended at Boonton Molding Co. by aircooling. The air passes through 4-in. space between two courses of refractory and carborundum brick and two courses of regular brickwork in outer wall. This preheated air then enters under stoker firebed through expansion-joint fittings. —POWER

Pin Breaks Coal—Using a 14-in.-long pin, driven by a 5,600-lb. weight saves Crowe Coal Co. $1,000 per month over blasting in a 29-in.-thick strip seam. Two sets of lifting lugs on a rotating chain hoist and drop weighted pin six or seven times per min., the caterpillar tractor moving forward or backward about 3 ft. during hoist. Pin has 4-in. dia. at base, 2-in. at point; drop is 12 ft. Loading shovel can work seam easily after pinning. —COAL AGE

Low-cost Plastic Venturi—Directly responsible for much of the industrial plastic applications in the metalworking industry, transfer molding has increased production of venturi for deepwell pumps and cut costs at Flint & Walling Mfg. Co. It makes possible necessary flow without extreme ram pressure. Only finishing required is removal of gates by sanding, removal of burr. —AMERICAN MACHINIST

Bus for Wheelchair Riders—Halifax Children's Hospital, Halifax, N. S., has modified a standard bus to accommodate wheelchair passengers. Passengers enter, in chairs, through rear door. —BUS TRANSPORTATION

Reclaim Cast-iron Water Pipes—Cast-iron water pipes are cleaned at the Atlanta, Ga., waterworks by shop-built cutting auger. Then pipe is lined with ⅛-in. layer of cement mortar, with slump of 9 in. Before lining settles, pipe is spun at 800 rpm. Crew of eight reclaims 20 sections of pipe per day at cost of 25¢ per ft. —ENGRG. NEWS-RECORD

For Single or Double Warping—Single or double warping of rubber, plastic, wire, or other yarn-like material is possible on the new Canister Co. machine. Molybdenum frame eliminates twisting and misalignment. Drive is by electric motor through V-belts; spindle speeds are adjustable from 1,000 to 1,500 rpm. by quick change of gears and pulleys. Micromatic control for upper and lower shaft speed is provided. Pushbuttons control operation of machine. —TEXTILE WORLD

Freezer Progress—To obtain good heat conduction and economy in fabrication of aluminum freezer compartment for its refrigerator, Servel, Inc., extrudes one compartment side with integral U-shape fins. Steel refrigerant coils are attached by bending fins over them in a large press. —PRODUCT ENGRG.

Hot Silicone Gaskets—Silicone rubber—Polyorganosiloxane—is being used as gaskets in high-temperature equipment such as gas turbines, air compressors, and diesel engine superchargers. It remains soft and resilient, has low permanent set, and it does not adhere to metals. —ELECTRICAL WORLD

Sectional Dip Tanks—Moveable sectional dip tanks, two stories high, have speeded production at Lyon Metal Products, Inc. Tanks are mounted on wheels and run on rails for ease in movement. Upper portion opens directly onto production floor; lower part, including controls, is on floor below. Sections permit one tank to hold several colors. Tanks are cleaned easily. —FACTORY

ADDED CARGO SPACE—In 20 min. unsold seat space in Pan American World Airways planes can be converted into cargo space with these light-weight stanchions and netting around forward four seats. Space for 2 tons of additional cargo can thus be provided. Pan American is fitting 32 of its fleet with them. —BUSINESS WEEK

Flying Life-rafts—On American Overseas Airlines, four rubber life rafts, with a capacity of 45, are now carried—three 10-man units, one 15-man unit. One is stowed in crew's compartment, two in cabin, and one in linen storage area. All are above escape doors, and are released by hand-pull. Ten-man unit weights 82 lb. Resembling two doughnuts, one on top of the other, each section is inflated separately by CO_2 cylinders. Flat section in top doughnut permits easy entrance onto raft. Each raft contains necessary repair equipment. —AIR TRANSPORT

Reduces Wool Pilling—Pilling of wool—the tendency of fibers to rub up into small balls—in outerwear garments can be reduced by introducing into the blend a small percentage of skin wool. Also, harder twist in spinning and plying twist operations will cut pilling action. —TEXTILE WORLD

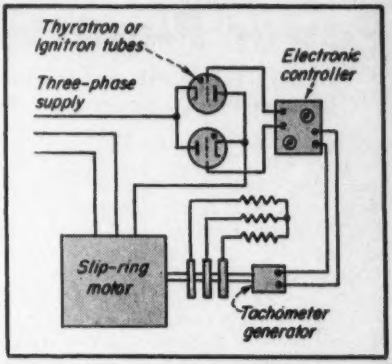
Fluxed Flame Cleans Wires—Using a torch in which the gas feeding the flame contains a flux, Westinghouse Electric Corp. quickly burns enamel from ends of wire in small electromagnetic coils so that these may be tinned without subsequent cleaning. Fluxing compound is in solution in highly volatile, inflammable liquid. A cotton wick is saturated with solution, and gas is passed through solution container and over wick to pick up flux. —WELDING ENGINEER

Better Boiler Setting—Five-years of operating experience at the electric generating plant in Springfield, Mo., shows a marked reduction in repair requirements for a sectionally suspended boiler wall, compared with solid masonry. Stack temperatures were 100°F. lower, CO_2 1.5% higher, and boiler losses 3-6% less. —POWER

Radio-Phone for Mine—A radio-telephone system has been installed between central office of Pittsburgh Coal Co. and tipple. Truck at tipple taps ac. power from transmission line, a small motor-generator supplying dc. for transmitter. Transmitter, receiver, and generator are behind truck cab; phone is under dash. —COAL AGE

Capacitors at Substations—To get a large amount of capacitive kvar on its electric power system as quickly as possible, Southern California Edison Co. is installing capacitors at distribution substations instead of out on feeders. The bus-tie oil circuit breaker is used for switching them wherever possible. —ELECTRICAL WORLD

Women Workers Careless—Survey of accidents at B. F. Goodrich Co. shows that women violate three times as many safety-regulations as men. —BUSINESS WEEK



CONTROLS MOTOR SPEED—Alternate application of three-phase and single-phase current to primary of a slip-ring motor gives accurate control of motor speed in the range of 2 to 25% of rated rpm. An electronic switching device varies duration of three-phase operation during each half cycle. An adjustable reference voltage is imposed by an electronic controller on grids of two inverse-parallel connected thyratrons or ignitrons in one branch of motor circuit. As preset speed is approached, a tachometer generator bucks reference voltage until phase of grid voltage is sufficiently retarded to supply enough three-phase power to maintain desired speed. —ELECTRICAL WORLD

New Hangar Design—Two recently constructed airplane hangars providing added clear space have been constructed by Austin Co. One hangar uses nine cantilever-type trusses to give a 110x266-ft. open area. Cantilever arms are connected to 50-ft. anchor arms along three jack trusses. In second hangar, a 120x275x65-ft. open area was obtained by jack-truss construction. Roof was fabricated on the ground and then hoisted into position. —ENGRG. NEWS-RECORD

Dynamite Settles Tower—One tower of a three-tower power transmission structure near a highway fill settled more than others. So small charges of dynamite were exploded 5-ft. beneath footings of other towers to increase settlement. —ELECTRICAL WORLD

Cuts Warp Stretch—By reducing diameter of the bottom, positively driven, front squeeze roll on a slacker 1/32-in., slippage between front and back rolls was eliminated. Surface speed of front roller is reduced sufficiently so that yarn is not stretched. —TEXTILE WORLD

Power Plant With New Ideas

Efficient new link in integrated electrical power system, Tidd Plant is designed for economy and reliability. It has many advanced features

Key link in an integrated power system, the new, efficient, and economical Tidd Station of American Gas & Electric Service Co. has these distinctive electrical features: (1) Use of a double-winding generator. (2) Auxiliaries supplied either directly off generator or from incoming bus. (3) Main transformers have welded-on covers, compactness achieved through reduced insulation, forced cooling, and a comprehensive fire-extinguishing installation.

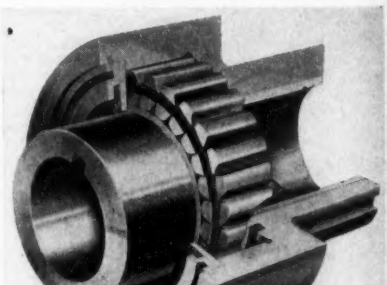
The double-winding generator is connected by a short route to three single-phase transformers stepping up to 132,000 volts, where a single breaker provides ample switching. Auxiliary power normally is direct from generator leads through two transformers, one on each winding.

Of the most modern forced-oil, forced-air-cooled, streamline design, the four main 42,500-kva. (single phase) transformers are relatively small and light, each weighing under 100,000 lb. and occupying 163x180-in. floor space and standing 134 in. high (case). Each transformer has an inert-gas cushion, and the usual gasket is eliminated by the welded cover. The transformers are installed in a row on a concrete structure. Below them are tunnels through which the gas-filled cables come from the generator. All transformers are separated by masonry fire walls, and each has facilities for selectively smothering fire by carbon dioxide.

Other significant aspects of the Tidd Plant are: The 66/132-kv. switchyard is entirely automatic. The control building is heated and air conditioned by a heat pump. Auxiliaries are supplied by alternative sources. Electronic relays are used in conjunction with the automatic synchronizing. A comprehensive communication system permits all personnel to be in constant touch with each other, no matter where they are. There are four means of communication: (1) intercommunicating and outside telephones; (2) carrier-current telephones; (3) public address system; and (4) test telephone system.

For the lower voltage auxiliary motors, what is essentially a ring bus has been set up. This is in four parts, each served by a transformer. There is ample capacity in the transformers on adjacent bus sections to handle the in-between section if its transformer fails.

Auxiliaries are served by delta-connected ungrounded neutral systems with ground detectors in each bus to warn of



STEEL CLUTCH—Useful for feed-roll and similar drives, new Formsprag overrunning clutch consists of hardened steel sprags between inner and outer cylindrical races. Contact with races is maintained by an energizing medium. Applied torque is transmitted from one race to other by gripping action of sprags. When torque is removed, sprags release their grip. Localized stress is minimized, wear distributed, in clutch of Gear Grinding Machine Co.—PRODUCT ENGRG.

difficulties and give time for locating and clearing grounds before they become short circuits.

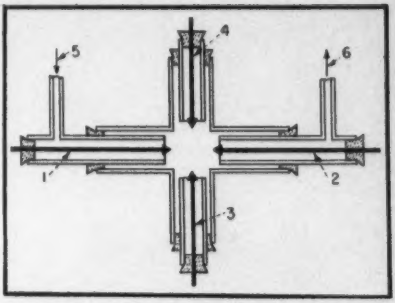
The automatic switchyard is independent of the generating station, and needs no attendant. It has its own storage battery control system and oil-handling equipment. The heat pump for the control building takes heat from the outside air. It utilizes water storage as auxiliary to the compressor system, is reversible for air conditioning during warm weather, and has automatic defrosting facilities. —ELECTRICAL WORLD

NEW EMULSIFIERS MAKE BETTER CAKE

Regarded as a major improvement in the science of cake baking, a series of bland, nontoxic, chemical emulsifiers may have application in other food emulsions, such as soups, sauces, condiments, fondants, chocolate, and desserts. Atlas Powder Co. produced the emulsifiers from corn sugar and stearic acid. They are partially stearated sorbital anhydrides and their polyoxyethylene derivatives. Their water solubility is varied by reaction with alkylene oxide. The emulsifiers preferably are hydrated and added to cake batter with the liquids. Optimum results are obtained when the emulsifying type of shortening also is used, for the emulsifiers in each phase combine to produce a practically perfect emulsion and cake. —FOOD INDUSTRIES

KEEPS AIRPORT DRY

Use of combined drains—perforated, corrugated metal pipes, and porous backfill—kept Ellington Army airfield operable with annual rainfall of 45.9 in., some storms bringing up to 4.26 in. per hr. Piping, laid in ditches along runways and aprons, was covered with no less than 2 ft. of porous material, average covering being 3 ft. Catch basins were placed every 350 ft. Capping material was no more than 5% passing 1-in. screen and no more than 5% retained on 2-in. screen. Mixture was bound together with a 3-5% asphalt emulsion. Over 5 yr. there was no silting. —ENGRG. NEWS-RECORD

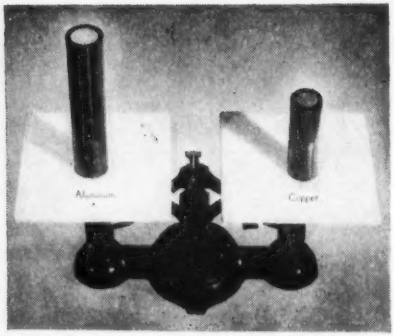


EFFICIENT FIXATION—Compared with the modern ammonia oxidation process for nitric acid, the "crossed discharge" method of nitrogen fixation involves low capital and operating costs. Electrodes 1 and 2 are connected to a high-voltage, 60-cycle supply; electrode 3 has a high-frequency (2.48 mc.) supply; and 4 is grounded. Air to be reacted enters at 5, passes through the crossed high- and low-frequency discharges, and exits at 6. As much as 300% yield of nitrogen oxides per kva-hr. or per kwh. is attained over the use of either one of the electrode components alone. —CHEMICAL ENGRG.

MAGNETIC AMPLIFIERS BECOME PRACTICAL

Magnetic amplifiers, invented in 1916 and pushed aside by vacuum-tube amplifiers, have been made practical by the use of high-permeability core materials and efficient selenium rectifiers. They essentially are saturable core reactors in which degree of magnetization and flux-change is controlled by auxiliary windings.

Being free of the mechanical limitations of vacuum tubes, this amplifier may provide the means for wider industrial application of techniques built around electronic amplifiers. Germany improved the American-invented device and successfully used it on naval vessels—for life of vessels. —ELECTRONICS



These cables weigh the same, carry the same current, and are similarly insulated. The 700,000 circular mil aluminum cable is twice as long as its 500,000 circular mil copper equivalent.

HOW ALUMINUM CONDUCTORS COMPARE WITH COPPER

Insulated aluminum is being considered for new uses as an electrical conductor because of the critical copper shortage. The 99.45% pure electrical conductor-grade aluminum has excellent corrosion resistance and exhibits good life outdoors, even near the sea coast. It is anodic to copper, however, and is corroded in contact with it in presence of a strong electrolyte. Thorough waterproofing of exposed aluminum-to-copper joints with rubber tape or paint probably is the most practical preventive practice.

Under rubber insulation, aluminum has high resistance to corrosion due to sulphur, whereas copper is easily corroded. Copper also accelerates the deterioration of rubber in contact with it, while aluminum does not.

Insulated aluminum wire and cables are made in essentially the same way as the copper conductors. No annealing is necessary, as with copper, since aluminum always is used in the "as drawn" state.

Aluminum has greater capacity for resisting impact loads in service in which the metal must not be permanently distorted, its modulus of resilience being about 6.4 times that for annealed copper. Aluminum conductors will be larger and hence have breaking strengths akin to those of copper cables. Further, they will be lighter for a given length, will require lower conduit-pulling tensions, and longer lengths can be held vertically. Fatigue resulting from wind vibration has safe limits, and the cushioning effect of insulation on open-wire aerial lines should eliminate concern over "notch effect" where the wire is secured. Usually, aluminum line wire is constructed with a galvanized steel core for high strength-weight ratio and attendant engineering and economic advantages.

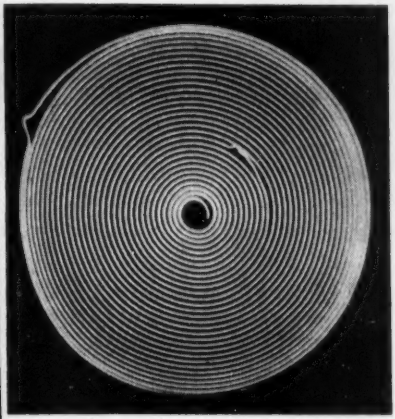
Indications are that creep rate of hard-drawn aluminum wire is somewhat higher than for copper, but is of no consequence with properly designed fittings. Temperature rise due to short circuit is about the same in an aluminum conductor as in a copper conductor with similar impedance or voltage drop. Softening of aluminum wire by thermal "recrystallization" does not occur below 150°C., but at 300°C. the annealing effect is rapid.

Direct-current resistance of aluminum at 25°C. is 1.640 times that of base copper. With ac., a 1,500,000 circular mil aluminum conductor will have about the same impedance as a 1,000,000 circular mil copper cable. —ELECTRICAL WORLD

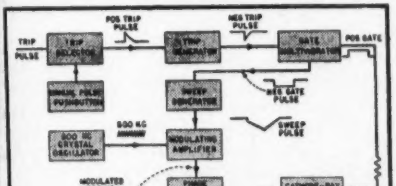
BELT WORKS UP 7% GRADE

Standard Coal Co. is using a 1,000-ft., 4-ply belt to pull coal from shuttle-cars up a 7% grade at a rate of 400 fpm., probably the first such installation in the country. Part of a complete mechanization program, the belt will soon be extended to 1,500 ft. A 35-hp. motor now drives the 1,000-ft. section; a 50-hp. motor will drive the longer section.

Currently, the belt is operating over a seam previously mined and caved. Coal averages 6 ft., dips an average of 9.8%.



1 SPIRAL SWEEP TIMER—Interval between two or more positive pulses can be determined to within 0.05 microsecond by photographing their oscilloscope display on a single spiral trace revolving once every 2 microseconds and having a total length of 25 to 100 microseconds. Spacing between pulses in this photograph of a cathode-ray tube display represents 38.55 microseconds.



2 TIMBER CIRCUIT — Interconnection of principal circuit elements in spiral sweep oscilloscope timer is shown by this block diagram. —ELECTRONICS

Now shuttle cars discharge over tail end of three chain conveyors being used temporarily to extend conveyor until longer belt can be obtained. After new belt is installed, special equipment will receive coal from shuttle-cars.—COAL AGE

METALWORKING EQUIPMENT TRENDS REVEALED

To speed production and reduce physical labor by workers, large installations of all types of materials handling equipment will be made by U. S. metalworking plants next year. The value of carbide tooling also is being recognized increasingly in these factories, and 44.2% of all new machine tools will be carbide-equipped. These are two of the trends revealed in a survey of 643 metal-working companies.

The survey showed that 8,669 machine tools, costing $59,987,900, will be bought by these companies. And 3,477 units of production equipment other than machine tools, costing $34,996,850, will be purchased. Management anticipates the 1948 business level to be about 20% higher than this year.

Other equipment trends indicated are: (1) 33.5% of all new machine tools will have hydraulic feed or drive. (2) 40.2% of all new machine tools will be tooled, at least in part, by the machine-tool builders. (3) Air conditioning equipment will be installed in 24 production plants, 99 offices, and 56 engineering departments. (4) 458 mechanical forming presses and 223 press brakes and shears will be bought. —AMERICAN MACHINIST

TUBES LIGHTEN CONCRETE

Fiber tubes placed between reinforcing bars in concrete trusses reduced dead load of bridge decking sufficiently so that span length could be increased 40%. Tubes are made of jute fiber, spirally wrapped with asphalt impregnated paper. Sections are 10 ft. long, 5⅛-in. O.D. Before placement, a paraffin coating is put on tubes by dipping. Concrete mix is 1 part cement, 1.3 parts fine aggregate, 2.5 parts ¾-in. gravel, and sufficient water to give a slump of 5 to 7 in. Cement is tamped around tubes. The fiber tubes will withstand 21 lb. per linear in. of pressure. —ENGRG. NEWS-RECORD

TRAILER FLAT-CARS—Flat-cars haul truck trailers between New York, Boston, and Providence. Trailers are loaded one evening and arrive the next morning. Cars accommodate two trailers and deck plates permit moving trailers from car to car. —AMERICAN AUTOMOBILE

STUDY REVEALS WHY ELECTRONIC TUBES FAIL

Causes of electronic tube failures were determined by analysis of weaknesses in defective tubes in the 18,800-tube Electronic Numerical Integrator and Computor (ENIAC).

Open heaters and damaged cathode coatings were the chief troubles. The main damage to coatings was blistering, probably caused by gas formation between sleeve and coating. During processing, these sleeves are exposed to a liquid bath. If not thoroughly cleaned before the oxide coating is applied, the liquid will infiltrate the seam, then cause blisters.

Of heater failures, 90% occured in 6L6 and 6SN7 tubes. It was found that the straight folded-type heaters in these types, combined with certain manufacturing features, were mainly responsible for the failures. In most of the open heater faults, the heater wire had pulled away from the support wire because the spot weld did not imbed the heater wire sufficiently in the softer support wire. About 90% of all faulty tubes with straight heaters either had the insulating coating chipped off their bends, or appeared to have had their insulating coatings shifted away from the bend while in a semi-liquid state by tilting before dry.

The 6L6 straight heaters gave most of their trouble in cathode-to-heater leaks. Heaters also were observed with the insulating coating worn away by rubbing of the cathode sleeve edge during vibration, expansion, and contraction. If one support were cut shorter before bending, the supports could be closer, reducing heater spread and reducing chances of rubbing. —ELECTRONICS

SPECIAL PAY CARDS SPEED MINE ACCOUNTING

Notched cards and special accumulative pay statements have eliminated overtime in payroll and accounting sections at Elk River Coal & Lumber Co. Miner fills in necessary pay data on notched card at end of each shift—including work done, hourly rate, total earnings, and check number. Foreman checks entries. Marginal codes indicate check number, departments, cost account, dates of absence, and reason for absence. Card first goes to checker. Few errors are found in miner's figures; slight errors appear when miner calculates the amount of overtime.

Cost accounting then gets card. By using marginal perforations, section can prepare itemized cost accounts in a day. Card finally passes to payroll section where information is transferred to accumulative pay card. In addition to cumulative pay, card lists tax and social security deductions, credit at company store, and mine script issued in lieu of cash. Miner signs itemized stub, carries stub to paymaster.

Operators report pay disputes have been cut to 10 per year since the system was adopted. —COAL AGE

Assembly Line Time-Savers

Chevrolet redesigned its prewar assembly line before reinstalling it. Time and labor savings were made through materials handling equipment

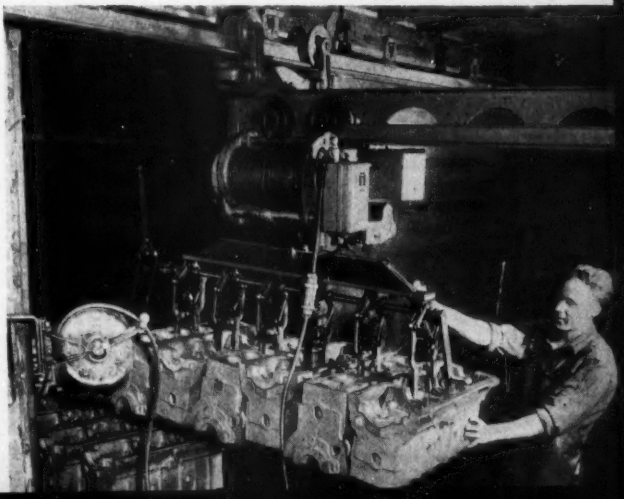
Before the prewar assembly line was reinstalled at Chevrolet Motors Div., the entire line was studied and changes made to increase productivity and to decrease worker fatigue. Many materials handling mechanisms were installed. Here are a few, noting efficiencies derived from installations:

Engine Shipping Racks—Formerly, a single I-beam rail and hoist with extension beam, located in the center of the railway car, lifted engine into car from conveyor, a special steel frame being bolted to bottom of engine. Engine was pushed by hand along a greased rack from center of car into position where it was locked in place with special clamps. Now a special framework, permanent rail, and telescoping bridge and hoist have been installed in each of the company's leased cars. Hoist runs the entire length of the car, placing engine in position for clamping. Savings—33% increase in loading efficiency and elimination of two men on loading section.

Crankshaft Handling — Machines with three work and one loading station, each holding two crankshafts, were loaded from an overhead conveyor, one 60-lb. crankshaft at a time. Now shafts are unloaded from the same conveyor with a special fixture. A hook removes two shafts from machine, places them onto a conveyor, and on return trip picks up two shafts from conveyor and places them at machine loading station. Production was increased 62%.

Casting Connecting Rods—Two men operated a pair of single-spindle casting spinners, one man dipping rod in the tinning bath, the other placing it in the spinner and pouring babbitt metal by hand. Connecting rods now are carried through the tinning bath by the conveyor. Then they are removed and placed in an 8-station revolving machine. As machine indexes, babbitt is applied automatically. Bearing is cast centrifugally. Production is increased 400%; work force is reduced 50%.

Collapsible Racks—Light but bulky material was unloaded from boxcars by



Six 160-lb. cylinder blocks now are unloaded at a time by special fixture suspended from an electric hoist in all company-leased freight cars. Blocks are moved directly to first operation by monorail conveyor. New fixture raised efficiency 40% and reduced physical exertion.

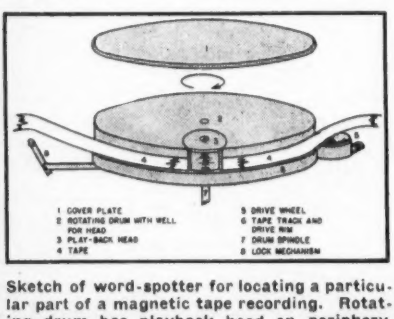
hand, stacked, and later placed in skid boxes. Now collapsible steel racks with removable wheels are pushed into freight car, material being stacked on them by hand. In storage areas, racks can be stacked three-high if wheels are removed from top two racks. As material is needed, wheels are replaced and transport truck tows racks to production area. Storage space has been increased 100%; labor has been reduced 50%. Damage to parts has been reduced greatly.

Skid Box Racks—Operator using four parts in one broaching operation formerly reached for parts in four different skid boxes placed on the floor. Now skid boxes are mounted on tilted tables, the front of the skid box being removed to permit parts to slide into special stock trays. The operator now can use both hands in operation at once; his output is increased 40%, and it is no longer necessary to stoop four times during each operation. —FACTORY

IMPROVES PERFORMANCE OF TAPE RECORDER

Using improved tape driven by three motors at a speed of 30 in. per sec., a new magnetic tape sound recorder for motion pictures and radio has an overall response flat within 4 db from 32 to 9,600 cycles.

The play-back head, the most critical component, is made in two halves from laminated, high-permeability material 6 mils thick. Only about 0.4 mil across, the gap in the head is filled with a nonmagnetic shim of beryllium copper.



Sketch of word-spotter for locating a particular part of a magnetic tape recording. Rotating drum has playback head on periphery.

As a tape coating, red oxide has been found to have better linear response than materials of greater cocercive force and remanence. It is made by oxidizing the ferrous black oxide.

Use of the equipment for broadcast or sound-track dubbing has been greatly enhanced by development of a "word spotter." Still experimental, this device plugs in to replace the head assembly. It is driven by the motor spindle and rubber idler that pulls the tape. The large driven drum of the spotter carries a playback head, so that if a short length of tape is held stationary, musical chords, syllables, or short words are repeated over and over. It is easy to spot desired portions of a recording with uncanny accuracy.

The recorder also may prove useful as a memory device for computer systems. To eliminate errors from possible cold flow of the plastic tape, which carries the magnetic powder, use of glass fiber tape is being investigated. —ELECTRONICS

ITALY'S INDUSTRY UP

Italy's industry is on the upswing. Raw materials, especially coal, are still short, but government officials hope their goal of 80-85% of prewar production will be reached this year. At mid-year, production was running 60%. At that time, Fiat automotive works was turning out 100 units per day, mostly trucks; rubber industry was meeting demand for tires.

The Ministry of Industry & Commerce has increased coal allocations 50% to the cement industry; 33% to chemical and pharmaceutical industries; 25% to rubber; and 21% to automotive, metal working, and shipbuilding industries. Engineering industries should get enough to maintain 70% of capacity; steel, 80%. Electric power output is 120% of prewar. —BUSINESS WEEK

NEW PROCESS BONDS SAPPHIRE TO METAL

Metallic bonding of synthetic sapphires to low-cost metals is now possible with the new Elgin Watch Co. and Armour Research Foundation process. A copper-base alloy is fused against the jewel, this layer being soldered or brazed to tool. Expansion rate of the copper alloy is between those of the jewel and the tool, equalizing the stress.

Jewel is shaped before fusing to copper alloy. Thermal shock must be avoided, and bonding must be done under uniform heat conditions. Joint is kept under pressure until bond hardens.

Technique has been used to put sapphire tips on tracer fingers on pantographs and on positioning points of automatic machinery. The process also may be used to affix synthetic jewel tips to gages. —BUSINESS WEEK

SHORT-HAUL AIRLINES

Atlantic Airlines plans to enter the low-cost, short-haul, air-passenger business, with stops as close together as 100 miles. Fares will approach the 3¢ per mile figure, considerably below the standard. Savings will be realized through elimination of personnel now used to process passengers prior to takeoff and by not carrying stewardesses. Passengers will arrive at airport by bus and board plane immediately, without checking baggage. They will handle own baggage and will surrender ticket to "flight manager" just prior to boarding plane.

Cargo compartments will be utilized for passenger space, as little freight haulage is expected. —AIR TRANSPORT

NEW CHEMICALS

Complex hydrated magnesium aluminum silicate now is produced by Attapulgus Clay Co. Called Attasol, it is unique in that it disperses readily in aqueous media, forms stable viscous suspensions with gel-forming properties, and its colloidal dispersions—which are not flocculated by electrolytes—have adsorptive and detergent powers. Indicated uses are precision and control of pH, as a washing powder, and as a frothing, flotation, and emulsifying agent.

Benzonitrile, said to be an effective solvent for vinyl resins, is being made on pilot-plant scale by Socony-Vacuum Oil Co. by combining toluene and ammonia in vapor phase with aid of a catalyst. The chemical may have insecticide properties and shows promise as a softening agent for natural rubber, as well as an intermediate in the development of new rubber, chemicals. —CHEMICAL ENGRG.

PLASTIC BALLOON—Children are rapidly turning from rubber balloons to these transparent plastic balloons. In a month, sales of the Vinylite bubble material rose 2,500%, 25 tons of the plastic base being used a day in manufacture. Plastic is sold in collapsible tubes, and bubbles are blown on short plastic tubes. —BUSINESS WEEK

NEW PRODUCTS

Tough Plastic Gasket—Functioning effectively under temperature range from −200 to + 500° F., a new thermoplastic gasket is not affected by acids, bases, or ketones. The polytetrafluorethylene plastic reacts only with melted sodium or fluorine under pressure. Gasket is a development of United States Gasket Co. —BUSINESS WEEK

Glass Electric Heaters — Metal resistance units are completely embedded in Pyrex or silica glass in immersion heaters produced by Thermolector Products. Heat transfer is said to be excellent and wire temperature low at 125-watt per sq. in. output. Capacities of the heaters are 600 watts at 120 volts and 1,200 at 240 volts. —CHEMICAL ENGRG.

Air-cushion Clutch—Inflation of a circular rubber tube in the new air-cushion clutch forces a friction disk against the back plate of the clutch to engage the unit. Air pressure can be varied by metering valves, and it is impossible to admit air fast enough to cause the driven machine to jerk. Osgood Co. developed the clutch. —PRODUCT ENGRG.

Rayon Lightens Rubber—Use of rayon as strength member in rubber hose used to bring compressed air to bench tools produces a much lighter hose. Raybestos-Manhattan, Inc., produces the lightweight hose in ¼- to ½-in. sizes. —MILL SUPPLIES

Sensitive Check Valve—Requiring no differential pressure to effect tight shutoff, the new Grove Regulator Co. check valve handles air, gas, water, or refined petroleum products at temperatures up to 180°F. Flexible tubular operating member is fully supported against extreme pressure or impulse shocks by inner walls of valve body and acorn-shaped core. —POWER

Weld Lighter—Controlled by a switch on the electrode holder, a new lamp directs a 10,500-candlepower light beam onto workpiece so that welder may see where arc is being struck. Plymouth Equipment & Supply Co. introduced it. —WELDING ENGINEER

Preserves Wood, Rope, Fabric—Cop-R-Nap, a solution of penetrating metal base naphthenates that fills the fibers of wood, rope, and fabric to repel fungi or insects, has been introduced recently by Osmose Wood Preserving Co. —ELECTRICAL WORLD

TAKES OUT IRON—Self energized pulley removes tramp iron from loose nonmagnetic product as it travels over conveyor belt. Product falls off end of belt, but iron particles are held to belt and released as belt carries them beyond pulley. Eriez Mfg. Co. introduced it. —FOOD INDUSTRIES

800-hp. Machine Tool—Equipped with a carbide cutter of 92-in. dia. and driven by an 800-hp. motor, a huge new miller dwarfs the so-called large 50-75-hp. tools. The Ingersoll Milling Machine Co. unit has an automatic chip removal conveyor handling 125 bushels a minute. —AMERICAN MACHINIST

New Pyrometer Developed—Ordinary thermocouple junction is enclosed in a small, light, silver shield in a new pyrometer developed by the U. S. Bureau of Standards. Shield keeps temperature of junction at nearly the same temperature as gas. Instrument is used to measure high-velocity turbo-jet temperatures. Pyrometer is accurate to within 5°F. in gas stream at 1500°, flowing with velocity of 250 ft. per min. —AVIATION WEEK

Aligns Forms—Inexpensive and simple to install, a new device aligns bottom of steel or wood forms. Anchors are placed near center of footing, 3 or 4 ft. apart. Parallel gage bar can be placed any time before forms are set, being adjustable to chalk line. Gage bar provides some anchorage between wall and footing. Device is a development of Williams Form Engineering Co.—ENGRG. NEWS-RECORD

Engine Analyzer—Vibration, knock, and ignition data are provided by an aircraft-engine trouble analyzer developed by Sperry Gyroscope Co. The unit is installed on the plane, with indicators at the flight engineer's position. Ignition is observed by a 3-in. cathode-ray oscilloscope. —ELECTRONICS

Protects Masonry—Formulated with chlorinated rubber, Para-Ston Tex is a new protective and decorative coating for concrete or other masonry. It resists alkali, the hydrolyzing action of water, and atmospheric exposure. It is made in white or various colors by Truscon Labs. —CHEMICAL ENGRG.

Glass Strengthens Paper—Fibrous glass yarn is laid lengthwise in parallel strands or in diamond-shaped pattern between layers of kraft paper. Sheets are asphalt-treated. Glass fibers do not absorb water, permit tight bond between layers, and add flexibility and tensile, tear, and puncture strength to shipping paper. It is an Owens-Corning Fiberglas Corp. development. —BUSINESS WEEK

Steam-fan Heater—Steam supplied to a revolving unit heater developed by J. L. Wing Mfg. Co. also operates a turbine to drive the heater fan. —FOOD INDUSTRIES

Lead Grease—Developed for open gears and bearings, Lead-Lube is a mixture of extremely fine metallic lead powder and high-grade grease. After a period of use, the new Knapp Mills, Inc., product forms a coating of lead over the gear and bearing surfaces, minimizing the requirements for additional grease. —CONSTRUCTION METHODS

Carbide-steel Grinder Blade—Hardness of tungsten carbide is combined with the strength of steel in a centerless-grinder work-rest blade introduced by Cliff Co. Sectional inserts of tungsten carbide form a long-wear surface. These are separated by strips of specially developed alloy and laid in a slot with supporting walls of steel to prevent chipping on jobs where brittleness makes ordinary tungsten-carbide work-rest blades useless. —AMERICAN MACHINIST

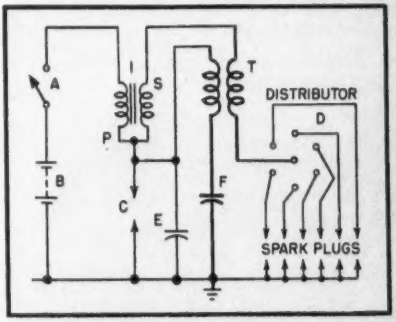
Recaps Tire Side-walls—White side-walls can be vulcanized to old side-walls with the new American Tire Machinery, Inc., unit. One half of a two-piece matrix is machined with side-wall contour for curing. Other half is noncuring and keeps tire in shape during curing. —AMERICAN AUTOMOBILE

New Recorder Idea—Typewriter ribbon and a vibrator take the place of ink in new recording volt and ampere meters introduced by General Electric Co. —ELECTRICAL WORLD

New Air Diffusion Tube—Of corrugated stainless steel wound with Saran plastic cord, a new air-diffusion tube for sewage treatment and for mixing in chemical processes is 60% lighter than previous tubes. Thin-wall construction reduces clogging, permits quicker cleaning. Tube is a Chicago Pump Co. development. —ENGRG. NEWS-RECORD

Plug-in Power Conductor—For secondary power distribution system, 10-ft. sheet-metal bus duct introduced by Federal Electric Products Co. contains a continuous electrical bus bar. Plug-in openings are 12-in. apart. Channel construction of inclosure and insulation of plug-ins make connecting and disconnecting of plugs safe. Supporting clamps are adjustable to hanger locations for easy installation. —PRODUCT ENGRG.

Dual-purpose Locomotive—When working on the reel for gathering cars, a new electric mine locomotive runs from creep speed to 5 mph. When running on trolley on main haulage line, it runs from creep to 7½ mph. Motors operate on full field only on reel, on shunted field on trolley. Westinghouse Electric Corp. developed the dual-purpose locomotive. —ENGRG. & MINING JOURNAL



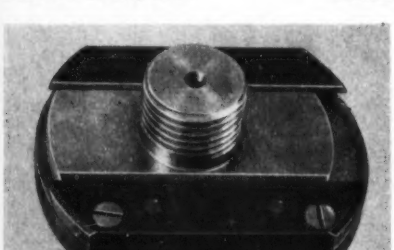
BETTER IGNITION—Effectiveness of spark ignition in automobiles can be increased by combining high-frequency oscillations with conventional heat sparks. Engineers of Tucker Corp. have found that h-f spark emanation at the plugs enhances ionization of the gases during combustion. Maximum power is then produced with a gas-air mixture ratio approaching 16:1, instead of the normal 12.6:1. The h-f spark circuit is shown. A secondary capacitor F and Tesla coil T in the secondary circuit of the high-voltage transformer produce oscillation. Continuance of spark across plug has been increased to about 35 deg. of crankshaft rotation. —ELECTRONICS

NEW PRODUCTS

Precise Potentiometer—More accurate than instruments wound with finest wire, a new German potentiometer has a resistance unit consisting of very thin strips of paper and Konstantan foil (60% Cu, 40% Ni). The strips are folded together accordion fashion and compacted under heat to a solid mass. Contact path has alternate edges of paper and foil, and 1 mm. has 40 gradations in resistance. —PRODUCT ENGRG.

New Press Saves Time—Saving in molding time of 20-30% is claimed for a duplex or compression molding press developed by Erie Engineering Corp. It has an upstroke duplex ram inside the main ram. A jack ram provides rapid approach stroke. Control of the self-contained, single-action, semi-automatic unit is by pushbutton, with automatic timers, stripper reset, and limit switches for upstroke, return stroke, and downstroke of the ram. —AMERICAN MACHINIST

Insulated Splice—Applied by a single squeeze of splicing tool, a new seamless-bronze, insulated splice for electrical conductors cannot slip or become detached. It is covered by a translucent, high-dielectric plastic insulator, is impervious to water, grease, oil, chemicals, or acids. Splice is a Thomas & Betts Co. development. —POWER



MAKES ELLIPTICAL SHAPES—Fastened to nose of lathe, new elliptical chuck holds conventional chucks or face plates. These, in turn, hold work which can be turned or bored into elliptical shapes. Slide of unit carries chuck or face-plate. It reciprocates with respect to drive plate. Drive plate rotates with spindle. H. D. Chambliss developed unit. —AMERICAN MACHINIST

Midget Aero Thermostat—To warn of excess heat in gearbox and bearings, to give high or low indications of fluid pressure, or to gage temperature of cylinder heads and exhaust stack, Control Products, Inc., has developed a thermal control and limit switch smaller than a cigarette. Unit operates on ac. or dc., 28-volt, 2-amp. current. The hermetically sealed unit is made of cold-rolled steel, stainless, brass. —AVIATION WEEK

All-nylon Truck Tire—Constructed entirely of nylon plies, a new rugged, high-speed tire has been announced by Goodyear Tire & Rubber Co. The 12-ply, all-nylon carcass is rated 50% stronger than rayon-ply tires. Nylon gives more flexibility than either cotton or rayon. —COAL AGE

Glass Heat Exchanger—To offer a high degree of sanitation to food and beverage processing industries, Valley Foundry & Machine Works has introduced a heat exchanger, with Pyrex inner tubes and return bends. Outer tubes, for steam or hot water, are steel. —FOOD INDUSTRIES

Little Dump Truck—Designed for multiple use in short hauls and small bulk handling, a new pick-up size dump truck has automatic hydraulic cab control. It is available as complete unit with 1½-, ¾-, or 1-yd. dump body or as kit for conversion of almost all standard pick-up trucks. National Truck Equipment Co. developed the midget dump truck. —CONSTRUCTION METHODS

Double-seal Check Valve—Designed to eliminate leakage and pressure loss completely, even when grit is present and pressure is 10,000 psi., a unique check valve has a metal-to-metal seat, plus a resilient rubber or synthetic rubber sealing ring. The check valve is made in ⅛- to 1-in. sizes by Mansfield & Green. —CHEMICAL ENGRG.

Explosion-proof Diesel—Based on prewar German Deutze design, an explosion proof diesel mine locomotive has been introduced by Columbia Aircraft Products, Inc. Exhaust gases are cooled by water spray and a flame trap; carbon monoxide gas is practically eliminated. —ENGRG. & MINING JOURNAL

Peels Off, Cleans Walls—Spray-painting booths can be kept clean by spray-coating them with a new formulation of Liquid Envelope, a peelable plastic film of Better Finishes & Coatings, Inc. When booth is ready for cleaning, film is peeled off in large sheets, removing accumulation of paint, lacquer, and spray dust. A 6 x 6-ft. booth is sprayed or stripped in 5 min. —PRODUCT ENGRG.

WASHERS ELIMINATED—No washers, valve seats, or other moving parts are used in this new seatless plumbing valve engineered by Power-Pak Products, Inc. Two synthetic rubber collars engage valve stem; upper collar prevents leakage to actuating thread, while lower collar acts as seal to close valve. Valve does not leak; operation is quiet. —BUSINESS WEEK

Midget Signal Tracer—A small signal tracer with its own speaker, the TS-5 Pocket Stethoscope is arranged so that any standard meter can be plugged in to convert the combination to an r-f vacuum tube voltmeter. Feiler Engineering Co. developed it. —CHEMICAL ENGRG.

Finds Nails in Tires—A permanent magnet in a new detector will locate nails, wire, or other ferrous material in a tire casing before tube is punctured. The Modern Merchandisers, Inc., unit, has a 6-watt bulb which lights when a metal object passes in front of it. Tires need not be removed from wheel during operation. —AMERICAN AUTOMOBILE

Meters Viscous Flow—Using a telemetering transmitter connected to an electronic receiver, Bailey Meter Co's new Area meter is said to measure viscous, as well as free-flowing liquids, accurately. Transmitter is installed in pipe line, and its port area is varied by a plug. Plug's position varies as flow rate, and movement varies voltage ratio in telemeter circuit. Two transmitters connected to recorder will measure ratio of two flows. —ELECTRICAL WORLD

Combination Resistor-Fuse—Custom-designed to circuit requirements, the new International Resistance Co. wire-wound resistor serves both as a resistor and fuse. At low power level it serves as a resistor; at high level its fuse function will break circuit when wire burns out. It is available in 1-watt rating, 15 to 150 ohms. —BUSINESS WEEK

New Gas Dispersion Filter—Stainless steel filters are welded at the periphery to shallow stainless steel disk in the new Micro Metallic Corp. gas-dispersion filter. Disk, in turn, is welded to standard female pipe connection. Porosity range is 5 to 65 microns. High flow capacities are accompanied by low pressure drops. Elements are available in 1, 1½, 2⅝, and 3½-in., pipe connections in ⅛, ¼, ⅜, and ½-in. —PRODUCT ENGRG.

Tough Coating—Mirrors protected by Silcote, a new coating material, are 1,600 times more resistant to abrasion. Developed by National Research Corp., the coating is applied by high-vacuum evaporation at 1,500°C., followed by heat treating. —CHEMICAL ENGRG.

Keeps Batteries Full—Water is maintained at proper level in automobile or truck batteries automatically by the Embree Mfg. Co. battery filler, which is filled only twice a year. Three hermetically sealed containers, mounted above or below battery, are connected to battery cells by feeder tubes inserted into specially drilled holes in cells. Engine heat expands filler cells, forcing water into battery; when battery cells are full, pressure cuts off flow. —BUSINESS WEEK

Hydraulic Power Package—Built for activating any hydraulically driven machinery, a power unit introduced by Hufford Machine Works is completely self-contained. It has motor, pump, valves, and flow controls mounted above a hydraulic reservoir and filter system. Built-in selector valve gives both forward and reverse motion to driven machine. Meter flow controls vary speed of machine. Units are available in sizes from 1 to 50 hp. —PRODUCT ENGRG.

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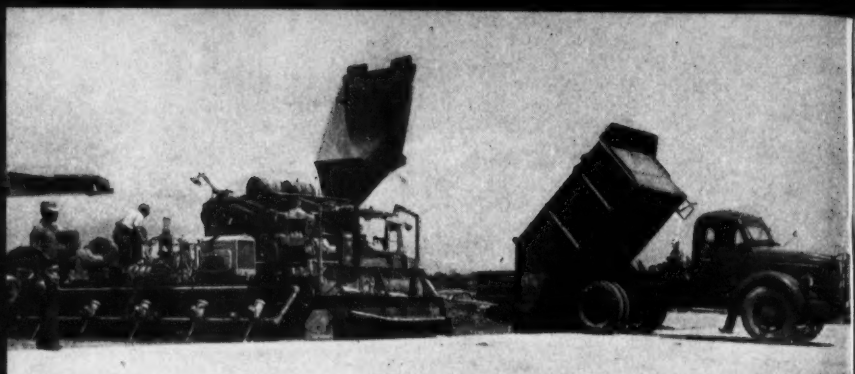


Dowel-studded 25-ft. strips of 21-in. slab make up a 300x10,000-ft. runway for bombers.

Paves Heavy Runways Quickly

A mass-concrete operation, construction of strips 21 and 25 in. thick is done at fast rate by modern equipment and efficient procedure

At Patterson Field, Ohio, new concrete runways for very heavy bombers will be 21 in. thick, the taxiway, 25 in. To place this concrete at a rate of 2,500 ft. of 25-ft. strip in two 8-hr. shifts, W. L. Johnson Construction Co. utilizes an unusually complete line of grading, concrete, and finishing equipment and employs a smooth-running construction procedure. The job involves placing 327,000 cu. yd. of concrete and moving 859,000 cu. yd. of earth.

All paving is in 25-ft. strips without expansion joints. Contraction joints every 28 ft. consist of a 3-in.-deep molded rubber-asphalt strip and 2 in. of poured Carey Seal, a new rubberized type of joint material. Reinforcing, set 4-in. from surface, is transverse pieces of surplus steel mesh landing mat. Adjacent strips are joined by 2¼-in. dia. solid steel load-transfer dowels, each 2 ft. long and set 18 in. center-to-center at midpoint in slab.

Aggregate from a nearby pit is screened and washed and delivered to a batching plant. Batch trucks feed five twin batch pavers, two at the forms and three set up as a central mix plant. Wet-mix, tight-body trucks, operating over finished strips, deliver concrete from central plant to the form for the first course (17 in.), assisted by one paver at the forms. Six electric vibrators on rear of spreader puddle concrete, and a second paver alongside the forms pours the 4-in. top course on top of the reinforcing. An air-entraining compound is added to the concrete at the mixers in the proportion of 1½ oz. per sack of cement.

Before concrete is placed, a three-drum sheepsfoot roller compacts subgrade to

90% maximum density. Full-width leveling is accomplished by a special 25-ft. blade on a motor grader, and guide rollers bearing on top and side of finished slab keep blade in proper position. After finish grading and rolling, subgrade is checked with a scratch template.

Special triangular steel forms, placed and moved by crane, are used. These have one 21-in. and one 25-in. face for use on both taxiway and runway and have holes to accommodate dowels. The forms are held by pins quickly driven by air hammer.

As top concrete is deposited, a finisher with a vibrating tube shakes it into a workable mass, and another machine gives final screeding to top of slab. Then the contraction-joint strips are placed by machine, and hand screeds do final finishing, being followed by a burlap drag. Finishers working from traveling bridges open up joints for pouring rubberized sealer. Final step in finishing is spraying with curing compound by a machine. —CONSTRUCTION METHODS

SPEEDS LUMBER HANDLING

Replacing hand movement of lumber with conveyors saves Ed. Roos Co. $130 per day. Conveyor system cost $7,500, so it will be amortized in 60 working days. Unit costs are down 10%, waste has been cut 5%, machine capacities are up 65–95%, and 65% of previous floor space has been saved.

Now lumber is delivered to primary planer by lift truck. Spacers are removed and returned to storage. As lumber is unstacked, it is fed onto planer and then onto conveyor. Separated according to size, lumber is fed to one of four rip saws, salvageable waste being carried by conveyor to joiner. Rips cut lumber for final gluing, lumber moving by conveyor to one of three stations. Conveyor carries lumber through gluing machines where heat and pressure bonds pieces into a continuous piece. This is delivered to veneer department. —FACTORY

OXYGEN-ARC CUTTING OFFERS MANY ADVANTAGES

Developed into a very useful tool for industry, the arc-oxygen process has been used successfully to cut high-chrome and chrome-nickel stainless steels, nickel, cupro-nickel, Monel, nickel-clad or stainless-clad steel, bronze, copper, brass, aluminum, cast iron, and mild low-alloy steels. Cutting is accomplished by directing a stream of oxygen into a pool of molten metal produced by an electric arc between the base metal and a coated, tubular, mild-steel rod. No preheating is required.

"Oxyarc" cutting requires little training. It permits cutting very close to finish line, minimizing grinding or machining. Welds machine relatively easily. Much time can be saved in fabricating complex shapes, because holes for flanges, manholes, or other types of connections can be cut in vessel after forming. Risers are easily removed from castings, regardless of material or shape; alloy ingots are effectively gouged; various types of metals can be cut in the scrapyard.

The process cuts ¾-in mild steel at 40 ipm.; ½-in. nickel at 5.5 ipm.; 2-in. cast iron at 2 ipm. —WELDING ENGRG.

MOVES MINING TOWN

Twelve 10-room, two-family homes owned by Jeddo-Highland Coal Co. were moved recently by rail to permit continuation of strip operations under old site. A four-rail system, comprising two sets of 60-lb. rail on 4 ft. 8½ in. centers, was laid to new site. House was jacked up, and a stripped-down mine car was backed under it. Then the house was pulled by caterpillar tractor over the mile route, which included grades of ± 6%.

Steel rollers were used to move houses laterally from track to exact location. Complete job, including new foundation and utilities, took five days. —COAL AGE

TELEVISION ASSEMBLY LINE SETS PACE FOR WORKERS

Laid out as a double-return circuit, each television assembly line at RCA Victor consists of a belt conveyor moving 50 ft. per hour past 80 assembly stations. Chassis are carried through practically all operations while supported on trunnion legs and inverted to bring the chassis bottom into convenient working position. Most assembly operations are performed in 2-min. cycles, making a total chassis-assembly time of 160 min. The conveyor paces the production at a rate established by standard-data time values.

Each operator who solders and crimps wires is guided by an operation sheet, placed directly in front of the station, which shows all joints to be soldered and wires to be crimped at that station.

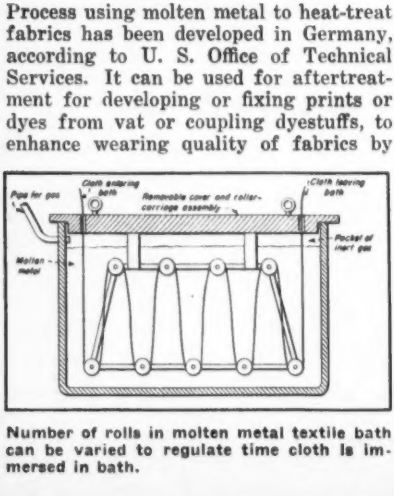
Besides 80 assemblers, each line requires 8 inspectors, 3 wire dressers, 4 repair men, and 10 testers.—ELECTRONICS

TEXTILES HEAT-TREATED IN MOLTEN METAL BATH

Process using molten metal to heat-treat fabrics has been developed in Germany, according to U. S. Office of Technical Services. It can be used for aftertreatment for developing or fixing prints or dyes from vat or coupling dyestuffs, to enhance wearing quality of fabrics by means of dimethylol urea or formaldehyde, and for crease and waterproofing.

Fabric is passed through slit in cover and wound around rolls which are suspended in the molten metal from cover. Molten metal may be lead-bismuth-cadmium, lead-bismuth-tin, or pure metals such as lead or tin. Temperature of metal varies up to 100°C., heating being done electrically or by direct firing. Inert gas fills area between molten metal and cover. This area could be used to accommodate dye.

Research in England reveals that colloidal dyestuffs have been floated on the molten metal bath, the heat and pressure of the bath setting the dye in fabrics. Cerrobend, a copper alloy melting at 158°C., has been used in England as the molten metal. —TEXTILE WORLD



Number of rolls in molten metal textile bath can be varied to regulate time cloth is immersed in bath.

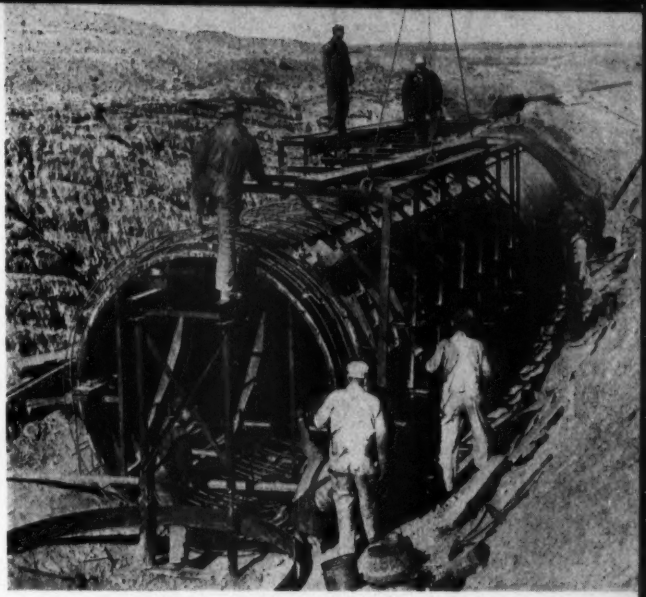
WORLD REBUILDING FLEETS

Merchant marine ship building is booming throughout the world. Busiest now are the British, producing 2,062,949 gross tons, 53% of the total tonnage on the world's ways. About 28% of her production is earmarked for foreign fleets. Sweden ranks second as a builder of ships, producing 266,905 tons, the bulk of which will go to Norway. France and The Netherlands rank third and fourth, primarily engaged in rebuilding their own fleets. About 50% of Italy's 191,000 tons will sail under foreign flags.

Sixth ranking ship builder is the United States, the world's largest builder two years ago. —BUSINESS WEEK

PROGRESS WITH ISOTOPES

Stable tracer isotopes in high concentration, as well as the instruments for quantitative determinations, now are commercially available at prices within the budget of many biochemical laboratories. Isotopes of practically every element can be obtained more or less readily. The difficult problems of instrument operation and maintenance have been eased



TIME - SAVING FORMS — In pouring 4,600 ft. of 9½-ft. concrete siphons, contractor used movable forms. Outer forms are in two halves that can be handled by crane. Inner form is supported on traveler. Reinforcing cage is prefabricated and hauled to job on low-bed tractor. After it is positioned by crane, traveler is run out of completed section of siphon, then inside form is pulled out to new position inside reinforcing cage. Next, the outside form halves are shifted by crane. —CONSTRUCTION METHODS

somewhat by improvements in design. The most important change, however, has come from the application of atomic piles to the production of an impressive variety of useful radioactive isotopes, in large quantities and at relatively low prices. Application of isotope techniques to previously unexplorable fields of research has been fruitful. —NUCLEONICS

3-DIMENSIONAL PICTURES

A second 3-dimensional photography process, called Akravue, has been announced by Harold A. Backus, inventor (McG-H Digest, Aug., p. 14). Depth impression is produced by rotation of object during photographing and by a vinylite lenticulating screen in camera. Process is usable in studio work only. Standard camera, lens, and film are used.

As object being photographed is rotated in horizontal plane, screen with vertical ridges moves across the film. Careful coordination is necessary between shutter speed, speed of rotation of object, and speed of lenticulating screen. After developing, print has a definite 3-dimensional effect when viewed through a ridged screen similar to one used in the camera. Screen has 80 lenticulations per in.

Kent Heath, Denver, Colo., also uses lenticulating lines in processing his three-dimensional film. His camera travels around a track while exposure is made. Reliephograph, Paris and Brussels, developed the travelling-camera principle. —BUSINESS WEEK

MEXICAN PLANT PRODUCES FLUID MILK FROM POWDER

Dry whole milk from the United States is being reliquefied in a $1,000,000 Mexico City plant and distributed "experimentally" to undernourished children with great success. Product is said to have better consumer acceptance than local raw milk.

Not only will another plant be built in Mexico City, but 25 more are planned throughout Central America and South America. —FOOD INDUSTRIES

CUTS BIG HOLES—New tools for heavy wood boring and counter boring consist of pilot drill and four tool-steel cutting blades. These Circo Tool Co. tools eliminate flying chips. Blades have no teeth to break; edges remain sharp longer, are easily resharpened. —CONSTRUCTION METHODS

OVERHEAD-LINE FAULTS LOCATED BY DETECTOR

Location of electrical faults on overhead power lines is easier, faster, and safer with a recently developed detector. Basically, the procedure operates by detecting the 300-cycle component of the current (5th harmonic) which flows to any accidental ground. The detector consists of a search coil and amplifier feeding into a micro-ammeter indicator.

For all normally ungrounded circuits, readings are made directly under lines. Then a 15-kva. capacitor is installed, preferably at the substation, and energized through a fuse between one clear phase and ground. A second detector reading at each previously recorded test location will show an increased indication along circuit route leading to fault. Reading drops sharply after accidental ground is passed.

On multigrounded lines, the faulted line is disconnected from its open supply switch and a 15-kva. capacitor "cut in," one terminal to the dead side of the switch, the other to the faulty-line section. After signal current is established, the particular pole on which faulty equipment is located can be quickly found by following the signal along the circuit. The "hot" wire of the circuit will carry more current than the ground wire between test capacitor and fault, little current beyond. —ELECTRICAL WORLD

NEW UNIVERSAL JOINT GIVES CONSTANT VELOCITY

Used for centuries, the Cardan universal joint does not transmit power with uniform angular speed when the shafts make an angle with each other. The cyclic variation occurs twice per revolution as the plane of the four trunnions, or power-transmitting elements, changes location in space. This *PTE* plane alternates between a position perpendicular to the driving shaft and one perpendicular to the driven shaft, and is not homokinetic.

In the recently developed Bendix-Weiss universal joint, constant velocity is achieved because the power-transmission elements are four steel balls whose plane does not change location. This is achieved by machining mating races for each ball into the two opposing yokes so that their centerlines intersect, thus determining one definite location of this

VERSATILE VALVE—Straight-through flow in the wide-open position and ability to throttle are features of a new corrosion-resistant tapered-plug gate valve. The Crane Co. valve is of outside-stem-and-yoke design to remove threads from contact with fluid handled. —CHEMICAL ENGRG.

Components of new universal joint.

ball. The plane containing the centerline of each race passes through the axis of the shaft to which the yoke is attached. By making the curvature of the two nonconcentric mating races identical in both yokes, but of opposite hand, the intersection point, determining the location of the engaging ball, always will bisect the angle between the two shafts. Thus balls are always in homokinetic plane. —PRODUCT ENGRG.

ELECTROLYTIC RECOVERY OF CHROMIUM DEVELOPED

Low-grade ores can be utilized in a new process for the electrowinning of chromium, developed to pilot-plant stage by U. S. Bureau of Mines. In the pilot plant, now producing 70 lb. daily, minus-28-mesh low-grade chromite concentrates are wet-ground to minus-270 mesh, dried, and stored. Batches are pressure-digested at 130-160°C. with spent anolyte from the electrolytic cell and some new sulphuric acid. The raw digest liquor is diluted with spent mother liquor to a solution containing about 42 grams of chromium and 150 grams of ammonium sulphate per liter, appreciable quantities of iron, aluminum, magnesium, and sodium, and small quantities of several other metals.

The solution is filtered at 65°C., and stabilized by heating to 80°C. for 1 hr. All of the aluminum and most of the iron and magnesium are removed in a vacuum crystallizer at 4°C., followed by centrifuging; chromium remains in solution. The purified mother liquor is clarified in a wooden filter press and aged in a Koroseal-lined thickener at 30°C. Chromium crystallizes as chromium ammonium alum, containing some ferric iron and small quantities of other impurities. Centrifuging removes the chrome alum; the spent mother liquor, containing about 22 grams of chromium per liter, is returned to the circuit.

One more crystallization of the chrome alum in a 2,000-gal. thickener at 30°C., using spent catholyte from the cells as recrystallizing liquor, reduces iron and other impurities below the critical concentrations. The iron in the crude alum is reduced to the ferrous state by the divalent chromium in the spent catholyte and does not recrystallize with the chromium. The pure chrome alum is mixed with glaubers salts, recovered from the impurity alums, and dissolved to produce cell feed containing 85 grams of chromium, 115 grams of ammonium sulphate, and 60 grams of sodium sulphate per liter.

The cell feed is added continuously to the cathode compartments of the pilot cell, and spent catholyte containing 10 grams of trivalent chromium and 20 grams of divalent chromium per liter is removed continuously and returned to the alum-recrystallization circuit. About 60% of the spent catholyte passes through the diaphragms into the anode compartment, where the chromium is oxidized to chromic acid.

The present pilot cell contains 5 brass or stainless-steel cathodes, each with 10 sq. ft. of submerged surface, and 10 lead-silver anodes. Cathode current density normally is 65 amp. per sq. ft., cell voltage is 4.2 to 4.5 volts, and normal production is 1.3 lb. of chromium per day per sq. ft. —ENGRG. & MINING JOURNAL

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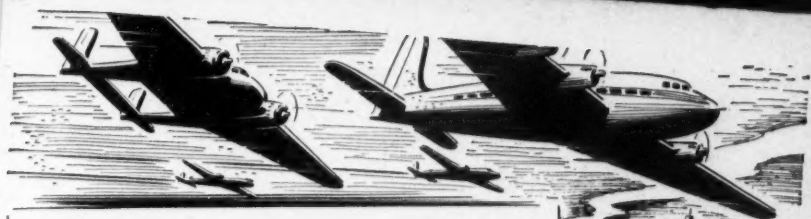

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